HDI 5000

Ultrasound System

Reference Manual

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A Philips
Medical Systems
Company

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United States federal law restricts this device to sale by or on the order of a physician.

CE 0086

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Read This First

About Your Manual Set

This manual is part of a manual set. The manual set addresses the reader who is familiar with ultrasound techniques. Sonography training and clinical procedures are not included in the manual set. The manual set includes the following:

- ***Getting Started*****:** Introduces you to basic system features and concepts. When you complete the procedures in this manual, you will know how to use these features and understand the concepts of system operation.
- ***Scanheads and Safety*****:** Contains information about safety, scanheads, biopsy guides, transesophageal and laparoscopic scanheads, and acoustic output.
- ***Reference Manual*****:** Contains information that supports and amplifies the procedures in *Getting Started*. It includes image management, maintenance, troubleshooting, specifications, references, and a glossary.
- ***Using Disinfectants and Gels*****:** Contains information about compatible gels and disinfectants and disinfecting ATL products.
- ***Acoustic Output Tables*****:** Contains information about mechanical and thermal index precision and accuracy, the acoustic output default tables, and the acoustic output tables.
- ***Medical Ultrasound Safety*****:** Contains information about bioeffects and biophysics, prudent use, and implementing ALARA (as low as reasonably achievable).
- ***Operating Notes*****:** Contains information that clarifies certain system responses that might be misunderstood or cause user difficulty.

About Your Manual Set on Compact Disc (CD)

A CD is included in a pocket on the inside back cover of the *Getting Started* manual. The CD contains the complete manual set, except for the *Operating Notes.* The instructions for using the CD are on the last page of the *Getting Started* manual.

Please take the time to use the CD, complete the brief survey card included with the manual set, and mail the survey card to us.

Conventions Used in This Manual

These conventions are used in this manual:

- All procedures are numbered. You must complete steps in the sequence they are presented to ensure a reliable result.
- Bulleted lists indicate general information about a particular function or procedure. They do not imply a sequential procedure.
- Control names appear in this manual like they appear on the system.
- Menu items or titles appearing on the monitor screen are shown in the manual like they appear on the screen.
- The left side of the system is to your left as you stand in front of the system, facing the system.
- Scanheads and pencil probes both are referred to as scanheads, unless the distinction is important to the meaning of the text.
- “Select” means to place the cursor over an item and press **SELECT** once.
- “Double-select” means to place the cursor over an item, and quickly press **SELECT** two times, like double-clicking with a computer mouse. Pressing **SELECT** too slowly on double select will only highlight an item. Pressing it rapidly will initiate an action.

System Conventions

These conventions are used in the system:

- The software that runs the system uses graphic display elements similar to those used in many personal computers. References to these elements in the software or in the manual are defined in the glossary in the *Reference Manual*.
- On a menu, protocol, or other display, a highlight bar indicates that the item or name contained within the boundaries of the highlight bar is in the process of being selected. Pressing the **SELECT** control or other related control actually selects the item, assigns a value to a system parameter, or initiates the action related to the selected item.
- On a menu, an underlined letter indicates that pressing the underlined letter on the system keyboard will have the same effect as choosing the menu item with the trackball and the **SELECT** control.
- On the system keyboard, pressing the **Superkey** and another designated key, for example **2D Maps,** allows you to quickly change a system parameter without using the menu on which the parameter appears.

- Pressing a key or control the first time initiates a mode change, function, or operation, or changes the value of a system parameter. Pressing the same key or control a second time resumes a previous mode or system parameter, cycles to the next setting, or ends the function or operation. All **MENU** controls work this way, and it can be quicker to press the **MENU** control than to select **Close**, especially to exit a submenu.
- On a menu, protocol, or other display, text that is lighter in color than the other text on the display indicates that the item or name contained within the boundaries is not available for selection in that menu, protocol, or display.
- A ■ or ◆ indicates an option or alternative for selection.
- A □ or ◇ indicates that an option or alternative has been selected.
- Selecting **Close** from a menu or display removes the menu or display from the screen.
- Selecting + or – increases or decreases the value of the parameter.
- An ellipsis ... on a menu indicates that a submenu is available from the selection.
- To highlight a menu, protocol, or other display item, use the trackball to move the cursor to the particular item.
- To enter text into a text field, use the keyboard.
- The softkeys, located on the lower right of the control panel, assume functions based on your control selections. For example, pressing **VCR CTRL** results in the softkeys assuming these VCR control functions: **PLAY**, **PAUSE**, **STOP**, **FF** (Fast Forward), and **REWIND**.

System Upgrades and Manual Set Updates

ATL Ultrasound is committed to innovation and continued improvement. Upgrades may be announced that consist of hardware or software improvements. Updated manuals will accompany those system upgrades.

Customer Comments

If you have questions about the manual set, or you discover an error in the manual set, please call the ATL Customer Service at (800) 433-3246; or if you are outside the USA, call the nearest ATL office, listed later in this section. You can also send electronic mail (e-mail) to ATL Technical Publications at the following address:

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Controls

This section contains information on all system controls, regardless of system configuration. It is arranged as follows:

- Monitor Module
- Control Module
- Main Chassis

For specific information about the VCR controls, the hardcopy device controls, network devices, or other peripherals see the manufacturer's instructions for those devices.

Monitor Module

The controls on the video monitor affect brightness, contrast, background color, and the brightness of the lightbar (Figure 2–1). When a control is pressed, an on-screen display provides information about the relative level of brightness, contrast, background color, or lightbar brightness (some monitors do not have an on-screen display for lightbar brightness). The on-screen display remains on until the timeout period ends, which is about three seconds after the control is last pressed. To reset the monitor module control setting to the default setting, press the increase and decrease controls simultaneously.

Before imaging with the system, wait about 20 minutes after turning the system on. The system can be used, but the video monitor requires a warm-up period. This warm-up period is necessary to ensure consistent image quality.

	Brightness adjusts the light output of the entire display.
	Contrast adjusts the difference in light output between the light and dark parts of the display.
	Background Color selects the background color of the display.
	Lightbar adjusts the brightness of the lightbar, which illuminates the control panel.

CAUTION

Maintaining a very high display-contrast level can damage your screen. Do not use high-contrast settings for an extended period of time.

Monitor Adjustment

Optimal brightness and contrast settings can vary in different lighting conditions and even from person to person. To minimize incorrect settings when there are multiple users, it is best to keep the monitor set to the default values.

" **To display the current monitor control settings:**

Press a background color, brightness, or contrast monitor control to display the current control setting (Figure 2–1). Settings are displayed for approximately 2 seconds. The lightbar brightness varies, but there is no on-screen display.

" **To adjust the monitor contrast and brightness to a default setting:**

1. Simultaneously press the up and down contrast controls twice to set the monitor to the factory default.
2. Simultaneously press the up and down brightness controls twice to set the monitor to the factory default.
3. Simultaneously press the lightbar controls twice to set the monitor to the factory default.
4. Press the background color control to select the background color on the display. Color 1 is the factory default option.
5. Press the lightbar brightness control to adjust control panel illumination.

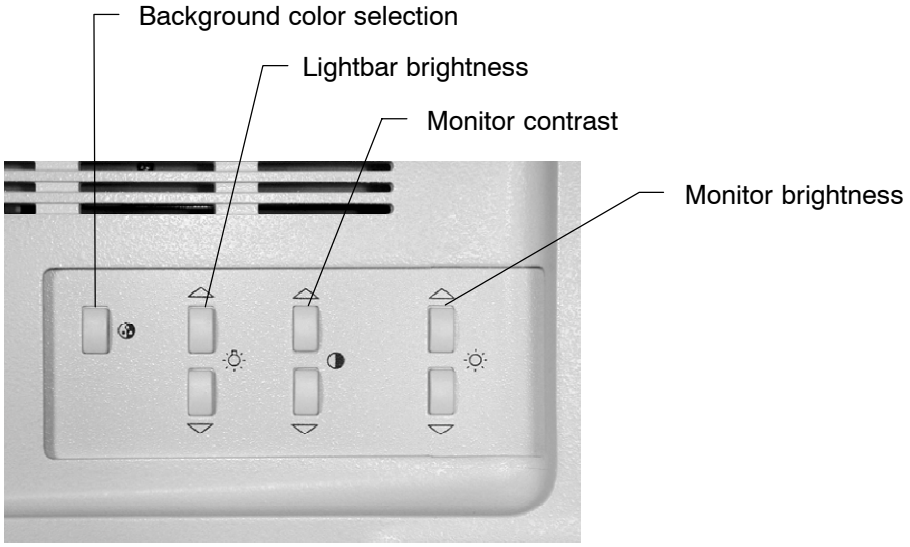


Figure 2–1. Monitor Module Controls

Monitor Latches

The monitor latch has been designed to avoid inadvertent unlatching when you place items in the tray under the monitor. The handle requires a tool (small screwdriver or metal rod) to unlatch it.

To unlatch the monitor, insert the tool in the center of the latch handle. Push down to rotate the latch handle to the down position. Slide the handle toward the rear of the monitor to unlock the latch. When the latch mechanism is unlocked, the latch handle hangs down (Figure 2–2), and then the monitor can be removed from the system.

The monitor latch secures the monitor to the system. It is not a tilt/swivel latch. The latch must remain in the locked position during normal system operation. Unlock the latch only to remove the monitor from the system. The latch is shown in Figure 2–2.

WARNING The monitor can fall off of the system if the latches are not locked.

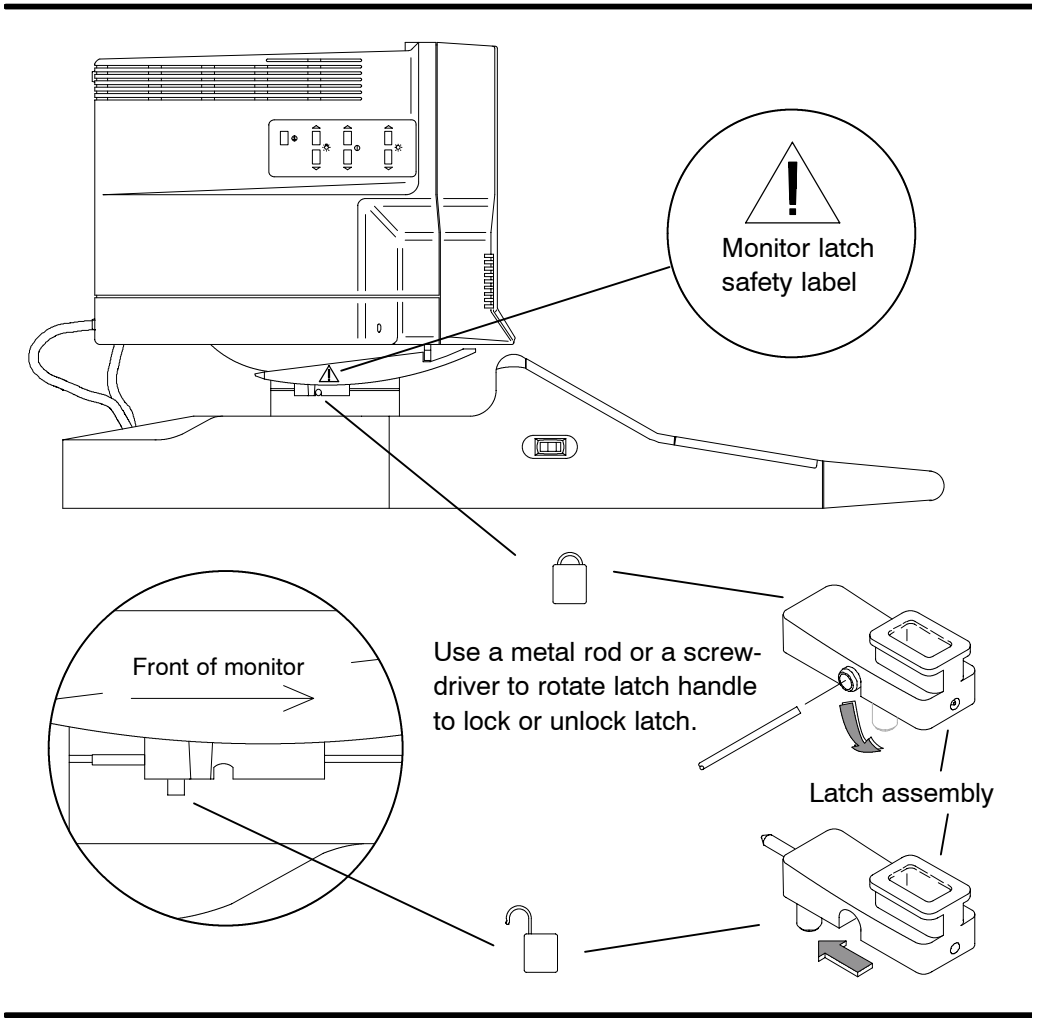


Figure 2–2. Monitor Latches

Control Module

See Figure 2–3.

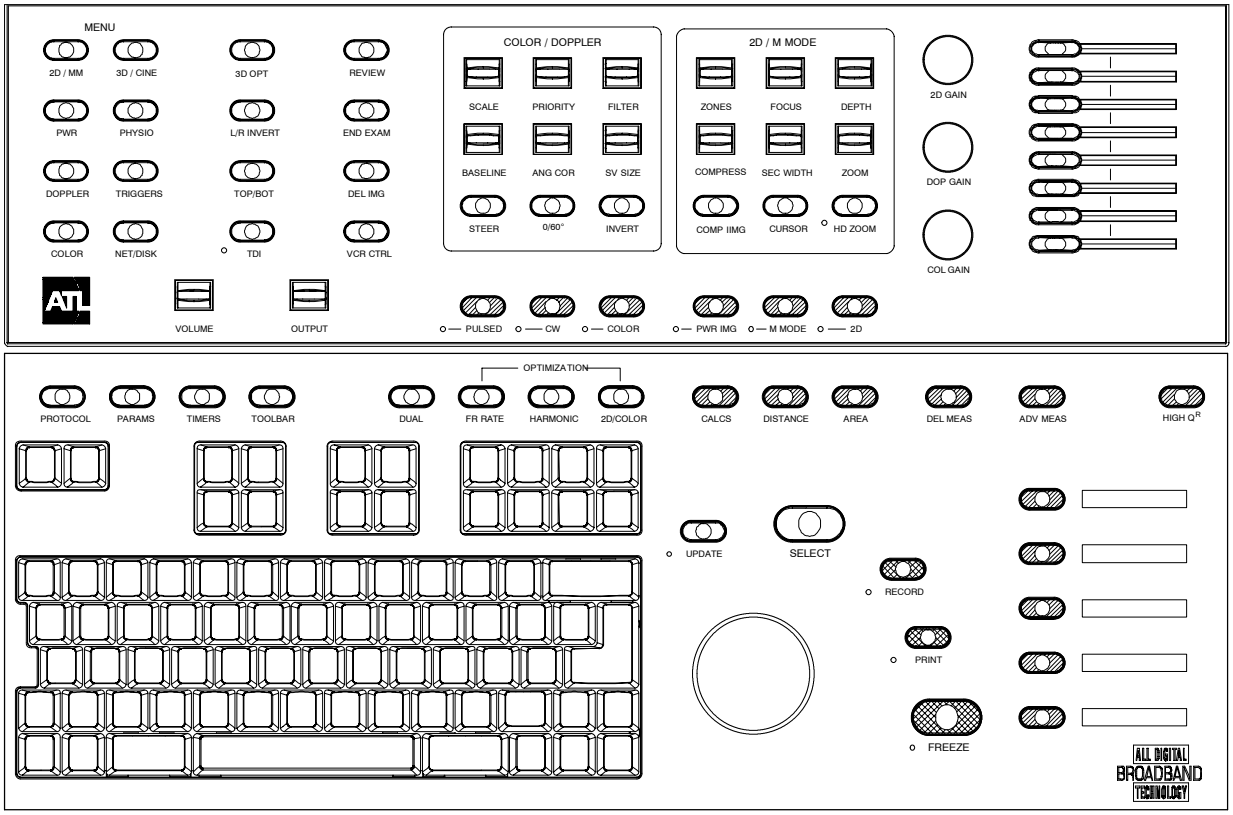


Figure 2–3. Control Module

0/60°

Selects a Doppler angle correction value of 60 degrees to the right, 60 degrees to the left, or 0 degrees angle correction. See also **ANG COR**.

2D

Starts 2D imaging. When 2D imaging is active, the indicator next to the control lights.

2D GAIN

Adjusts the receiver gain for the 2D and M-mode image displays. Turn the control clockwise to increase the gain; turn the control counterclockwise to decrease the gain.

2D/COLOR OPTIMIZATION

Selects from among up to three different fundamental optimization settings for 2D, Color, TDI, or Power imaging. Settings are dependent upon the active Tissue Specific preset.

2D/MM MENU

Displays a menu with 2D display parameters: Gray Maps (**GMap**), **Chroma** (gray-scale colorization), **Persistence**, **TIs/TIb**, **Biopsy Sel**, **2D PRF**, and **Biopsy**. The following M-mode display parameters are also available from this menu: **Speed** and **Display**.

3D/CINE MENU

Displays a menu with Cineloop review parameters that control the Cineloop sequence, change the speed of the Cineloop playback, select loop or sweep playback, and trim the Cineloop sequence. The selections related to 3D imaging are as follows: **Create 3D**, **Views**, **Slice**, and **Cine**. With the Advanced 3DI Position Sensor, a **Resolution** selection is also available.

3D OPT

Press **3D OPT**, during 3D imaging, to optimize the image for either general imaging, or cardiology. The display indicates the system is optimized for 3D as follows: **2D Opt:Gen 3D** or **2D Opt:Res 3D**.

ADV MEAS

Displays the **Meas Tools** menu. The **Meas Tools** menu includes the following measurement tools: **Volume**, **Vol Method**, **Vol Flow**, **CO** (Cardiac Output), **Heart Rate**, **Time/Slope**, **Calibrate**, **Set Region**, **Mean Tr (Mean Trace)**, **Trace**, and any optional measurement tools that you have purchased. Optional tools include % Area Reduction (**% Area Red**), % Diameter Reduction (**% Diam Red)**, **Hip Angle**, and **d:D Ratio**.

ANG COR

Corrects for the angle between the beam axis and the direction of flow. The cosine theta of this angle is used in the Doppler equation to calculate the velocity of blood flow. The range of Doppler angle correction is –70 degrees to +70 degrees in 2-degree increments. Push the control up to rotate the flow direction cursor in the clockwise direction; push the control down to rotate the flow direction cursor in the counterclockwise direction. See also **0/60°**.

AREA

Displays a measurement cursor, initiates an area and circumference measurement, ends a measurement, and cycles through the available 2D or Doppler tracing methods.

BASELINE

Shifts the Doppler zero baseline for Doppler and Color imaging.

CALCS

Displays the calculations menu or measurement protocol that supports the active scanhead and clinical option.

COL GAIN

Adjusts the receiver gain for the Color or Power imaging display. Turn the control clockwise to increase the Color or Power gain; turn the control counterclockwise to decrease the Color or Power gain. Also adjusts the saturation of the VCR playback display.

COLOR MENU

Displays a menu with Color display parameters: **Color Maps**, **Persistence**, **Post Process**, **Sensitivity**, Line Density, (**L Density**), **Mode** (velocity, variance, and power), Dynamic Motion Differentiation (**DMD**), **Blending, Smooth,** and **Units**.

COLOR

Turns Color imaging on and off. Displays the previously active imaging mode. When Color imaging is active, the indicator next to the control lights.

COMP IMG

Activates SonoCT Real-time Compound Imaging. This control is active only for specific scanheads that support this option. When active, an indicator next to the control lights.

COMPRESS

Changes the dynamic range of the 2D image. The dynamic range of the Power image can be changed from the **PWR** menu.

CURSOR

During 2D imaging, displays a line of dots that corresponds to the M-line (for M-Mode) or D-line and a depth cursor (for Doppler). The locations of the line and the depth cursor will be used for data acquisition when you initiate a scrolling display. You can add the angle correction cursor by pressing the **ANG COR** control.

CW

Press CW to turn on continuous-wave (CW) Doppler imaging. Press again to turn off CW Doppler imaging and display the previously active imaging mode. When CW Doppler imaging is active, the indicator next to the control lights.

DEL IMG

With the Image Management option, deletes the last image stored on the hard disk. With the Digital Video Streaming (DVS) option, deletes the selected review image.

DEL MEAS

Deletes the current measurement or a portion of the currently displayed circumference trace.

DEPTH

Changes the image display depth.

DISTANCE

Activates the first cursor for a distance measurement.

DOP GAIN

Adjusts the receiver gain for the Doppler image display. Turn the control clockwise to increase the Doppler gain; turn the control counterclockwise to decrease the Doppler gain. Also adjusts the tint of the VCR playback display.

DOPPLER MENU

Displays a menu with Doppler display parameters: **2D Update**, **Gray Maps**, **Chroma, Scale Units**, **Speed**, and **Display**.

DUAL

Provides access to the dual image display. Dual images can be used for measurements in a single image, if system requirements are met. Measurements are not allowed otherwise. The **UPDATE** control is used to alternately activate the images.

END EXAM

With the Image Management option, press this control to end the current patient exam.

FILTER

Changes the value of the Doppler, Power, or Color wall filter.

FOCUS

Changes the depth of the focal zones. Pressing the control moves the focal zones up or down to a shallower or deeper depth as reflected by the focal zone markers on the display.

FREEZE

Freezes all displayed images and captures the previously displayed frames for Cineloop review, M-mode review, Doppler review, and 3D creation. Displays the **CAPTURE** softkey, which is used to capture loops for image management and review.

FR RATE OPTIMIZATION

In SonoCT Real-time Compound Imaging, changes the scanhead sweep between **Survey** and **Target**. Also changes the frame rate during 2D, Color, and Power imaging.

HARMONIC OPTIMIZATION

Selects from among up to three different harmonic optimization settings for 2D THI, TDI Harmonic, 2D CSI, or Flow CSI. The settings are dependent upon the active Tissue Specific preset.

HD ZOOM

During acquisition, provides optimal processing power to a selected region of interest. An active (real-time) display is required for this feature.

HIGH Q®

Turns on or turns off the peak Doppler trace display, and initiates the automatic calculation and display of the specific values associated with the Doppler waveform.

INVERT

Inverts the pulsed- or continuous-wave Doppler display or Color display relative to the baseline.

L/R INVERT

Selects the left or right orientation of the 2D image. An orientation marker adjacent to the image display denotes the setting of this control.

M MODE

Displays M-mode imaging. Press a second time to return to the previous active imaging mode. When M-mode imaging is active, the indicator next to the control lights.

NET/DISK MENU

Displays a menu with network and disk parameters that control formatting and ejecting an optical disk, viewing the hard disk and optical disk exam directories, and getting disk capacity and network status. With the DVS option, the patient directory is available from the menu.

OUTPUT

Adjusts the ultrasound power output. Pressing this control up increases the acoustic output as reflected by an increase in the thermal index and mechanical index values; pressing it down decreases the acoustic output as reflected by a decrease in these values.

PARAMS

With the DVS option, displays the **Exam Parameters** dialog box, from which you can adjust capture format, ECG trigger, compression, and capture length for the active acquisition protocol. During freeform capture, the **Exam Parameters** dialog box displays the parameters for clip acquisition.

PHYSIO MENU

Displays a menu with physio parameters that control the display of the ECG trace and the physio channels A and B. You can then increase or decrease gain, raise or lower the position of the physio traces, and display the **TRIGGERS** menu.

PRINT

Prints to the destination specified in the **Peripherals** and **Image Management** setups. With the DVS option, stores images on the hard disk.

PRIORITY

Establishes the priority of display of gray-scale versus color information during Color and Power imaging. The indicator on the gray scale graphically represents the gray level or echo amplitude above which gray-scale information will be displayed and below which color information will be displayed.

PROTOCOL

With the DVS option, displays the **Protocol Start** dialog box from which you can select an acquisition protocol.

PULSED

Turns on the pulsed Doppler display. Press again to turn the pulsed Doppler display off and display the previously active imaging mode. When pulsed wave Doppler is active, the indicator next to the control lights.

PWR IMG

Displays Power Motion imaging or Color Power Angio imaging, depending upon the clinical option selected. Press a second time to return to the previously active imaging mode. When Power imaging is active, the indicator next to the control lights.

PWR MENU

Displays a menu with Power Motion imaging display parameters: **Power Maps**, **Persistence**, **Post Process, Sensitivity**, **L Density**, **DMD**, **Background**, **Display**, and **Dynamic Range**. DMD is unavailable in cardiology clinical options.

RECORD

Initiates a recording of the video display on the system VCR. During recording, press this control to pause the recording.

REVIEW

With the Image Management and the DVS options, allows review of stored images.

SCALE

Changes the pulse repetition frequency and the range of the displayed velocity or frequency display range in Color, Power, and Doppler imaging. Automatically initiates high PRF, when maximum velocity or frequency threshold is attained. Multiple sample volumes are displayed.

SEC WIDTH

Changes the width of the 2D sector.

SELECT

Initiates an action or enables a control. Also allows you to select a trackball option from the trackball selection menu, which briefly appears above the image display.

STEER

Selects among three possible steering angles for linear array scanheads. The exact angles are scanhead dependent.

SV SIZE

Changes the sample volume size. The available settings are as follows for all scanheads, except the D2 TC pencil probe: 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0 5.0, 7.5, 10.0, 12.5, and 15.0 mm. The D2 TC pencil probe has the following settings: 1.5, 2.0, 3.0, 5.0, 10.0, 15.0, and 25.0 mm.

TDI (Tissue Doppler Imaging)

With a compatible scanhead, in 2D Color, Color M-mode, and pulsed-wave Doppler, activates the TDI display.

TGC Slide Controls

Each slide control adjusts the receiver gain for the 2D and M-mode image displays at a particular depth. When the slide controls are set in the center, a default curve is assigned that gives a uniform gain throughout the image display. The TGC curve on the screen does not directly correlate to the TGC slide control positions. Color, Doppler, and Power imaging are not affected by the TGC slide controls; these modes assume a flat TGC curve.

TIMERS

With the DVS option, controls three timers used in freeform capture and acquisition protocols.

TOOLBAR

With the DVS option, displays the image-review toolbar. Press a second time to remove the image review toolbar.

TOP/BOT

Changes the top and bottom orientation of the image display. An orientation marker adjacent to the image display denotes the setting of this control.

Trackball

The trackball is used to move display elements of all types. Press **SELECT** to cycle among the available trackball options. The options appear immediately above the 2D image display.

TRIGGERS MENU

Displays the **Triggers** menu. The **Triggers** menu contains selections for changing the timing of image update relative to cardiac cycles.

UPDATE

In ECG-triggered imaging, activates ECG update based on the triggers you have selected. In dual imaging, switches between the two images: if the dual display is active, pressing **UPDATE** toggles between activating the left and right images; if the dual display is frozen, pressing **UPDATE** switches between the display of the Cineloop sequence related to each image. In duplex, **UPDATE** activates the 2D image or the scrolling display. In simultaneous, **UPDATE** switches between simultaneous and duplex update.

VCR CTRL

Allows the VCR to be operated from the system control panel. Displays **PLAY**, **PAUSE**, **STOP**, **FF**, and **REWIND** softkeys.

VOLUME

Push the control up to increase the audio volume from the system speakers. Push the control down to decrease the audio volume from the system speakers.

ZONES

Selects the number of focal zones and the distance between them. The maximum number is five. The range and number supported depends upon the type of scanhead being used.

ZOOM

Magnifies the image in freeze or real-time. There are eight settings. The trackball can be used to pan the magnified image to see areas that are not displayed.

Softkeys

There are five softkeys located on the right side of the control panel. The softkeys that appear are dependent upon system operation. For example, when you press **VCR CTRL**, the VCR softkeys appear.

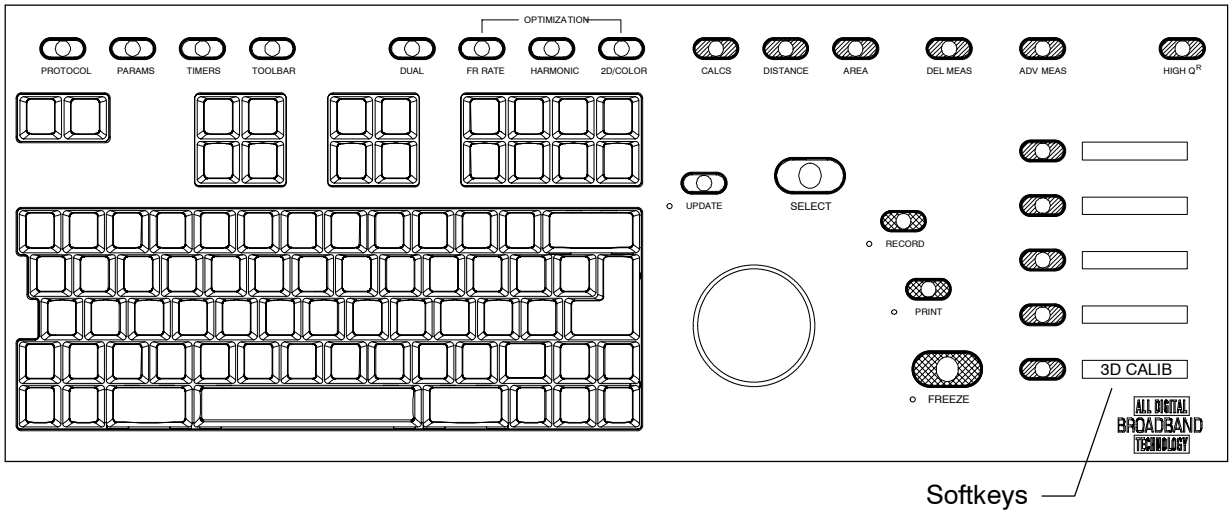


Figure 2–4. Softkey Controls

2D CINE

Plays back the 2D Cineloop review.

3D CALIB

Displays the **3D Calib** menu, which includes selections for resolution, trigger delay, trigger interval, frames, and frame interval, memory used, delay, even, systole, and R-R. With the Advanced 3DI option, initiates calibrated 3D acquisition.

3D UNCAL

Starts and stops Cineloop acquisition for uncalibrated 3D image rendering.

ACCEPT

Accepts image clips for storage to the hard disk.

CANCEL

In 3D imaging, closes the **3D Calib** menu, aborts the current 3D acquisition, and returns to 2D imaging. With the DVS option, stops image capture, deletes image frames captured for the current view, and resets the softkeys.

CAPTURE

Initiates the acquisition of a clip.

DONE

With the DVS option, stops image capture.

END

With the DVS option, ends an acquisition protocol, the image collection for the stage, and advances to the next stage of an acquisition protocol.

FF

A VCR control used to fast forward the VCR.

LABEL VL

Used to label and store a 3D image sequence using a **Label Volume** form.

PAUSE

Temporarily freezes acquisition. Enables the **CANCEL** and **RESUME** softkeys. A VCR control used to pause the VCR.

PLAY

A VCR control used to play the VCR.

REJECT

Deletes a selected clip and returns to real-time imaging.

RESUME

Resumes 3D acquisition. With the DVS option, resumes image capture.

REWIND

A VCR control used to rewind the VCR.

START

Closes the **3D Calib** menu and begins acquisition. Enables the **CANCEL** and **PAUSE** softkeys.

STOP

A VCR control used to stop the VCR.

STORE

Stores selected images to the hard drive. Unselected images are discarded.

STORE VL

Stores an acquired 3D image volume to the system hard disk. Also initiates data transfer to the workstation or the magneto optical disk, depending on your system's network setups.

VIEW >

Advances to the next logical view in a stage of an acquisition protocol.

VIEW <

Returns to the previous logical view in a stage of an acquisition protcol.

Keyboard

The keyboard contains special function keys, alphanumeric keys, annotation keys, and superkeys (Figure 2–5). With the special function keys, you can perform specific functions, such as choosing a scanhead or changing setups. The alphanumeric keys are used with the annotation keys to enter text. The superkeys are used with the **Superkey** (there are two, for convenience) to more quickly adjust various image display processing or format characteristics.

The superkeys, labeled with small text below the characters, allow quicker adjustments than if you use the corresponding **MENU** controls. Using the superkeys results in an immediate change to the setting. A five-second prompt appears above the image display to indicate the new setting. The image display and the image information is slso updated to reflect the new setting.

On a menu, an underlined letter is a keyboard equivalent. When you press a keyboard equivalent, the result is the same as selecting the menu item.

The following paragraphs describe the functions of each of the keys on the keyboard that have special functions. Alphanumeric keys that do not have special functions are simply used for text entry, and they are not listed or explained in the following.

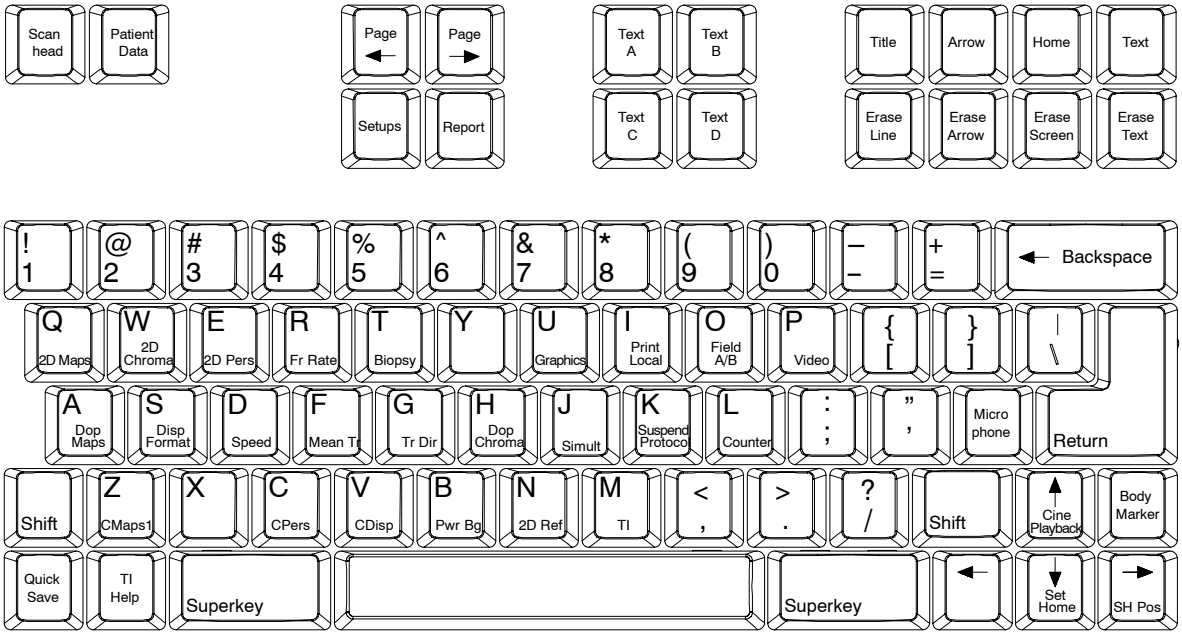


Figure 2–5. Keyboard

↑ ←↓→

Press these keys to move the annotation cursor in the direction the arrow points. Press **Shift** and an arrow key to annotate the image display at the cursor location with an arrow that points in the direction of the arrow key. The trackball can then be used to position the arrow on the display. Additional arrows may be displayed by pressing shift and this key.

1,2,3,4

Press the **Superkey** and one of these keys to select a scanhead, if the scanhead is compatible with the currently selected Tissue Specific preset. The numbers correspond to the scanhead receptacles: 1 corresponds to the scanhead receptacle on the left, 2 the middle, 3 the right, and 4 is the pencil probe receptacle. If the scanhead is not compatible with the currently-selected Tissue Specific preset, then the system will prompt you to select a scanhead and a Tissue Specific preset.

2D Chroma

Press the **Superkey** and this key to change the 2D imaging Chroma map.

2D Maps

Press the **Superkey** and this key to change the 2D gray map.

2D Pers

Press the **Superkey** and this key to change the 2D persistence setting. You cannot change persistence, dynamic range, or frame rate when the system is in freeze.

2D PRF

Press **Superkey** and this key to cycle the frame rate in all modes through **Low**, **Med**, and **High** values. **2D PRF** is equivalent to the **2D PRF** selection on the **2D/MMode** menu. Selecting an alternate 2D PRF setting may reduce or eliminate reverberation artifact.

2D Ref

Not functional at this time.

Arrow

Displays an arrow on the display. Use the trackball to move the arrow. Press the **SELECT** control to anchor the arrow. Press **Arrow** again to display another arrow.

Biopsy

Press the **Superkey** and this key to turn on or turn off the display of the biopsy guide line.

Backspace

Erases the character to the left of the cursor.

Body Marker

Selects a body marker. Once the body marker is displayed, you can use the trackball to move the body marker. The available body markers are dependent upon the Tissue Specific preset.

CDisp

Press the **Superkey** and this key to turn on or off the display of color on the image.

Cine Playback

Press the **Superkey** and this key to alternate between play and pause in Cineloop review.

CMaps 1

Press the **Superkey** and this key to change the color map.

Counter

Press the **Superkey** and this key to display a dialog box that can be used to set the VCR frame counter, search the tape for a specific frame, or cancel the operation. The frame counter is turned on or off in **Setups**.

CPers

Press the **Superkey** and this key to change the 2D Color or Power Motion persistence level. Ensure that the system is not in freeze; you cannot change persistence, dynamic range, or frame rate when the system is in freeze.

Disp Format

Press the **Superkey** and this key to change the size of the scrolling display.

Dop Chroma

Press the **Superkey** and this key to change the Doppler Chroma map.

Dop Maps

Press the **Superkey** and this key to change the gray map that is used for the Doppler imaging display.

Erase Arrow

Erases an arrow from the display.

Erase Line

Erases a line of text. The cursor must be located on the line of text that you want to erase.

Erase Screen

Erases text, title, body markers, arrows, and scanhead position markers from the display.

Erase Text

Erases user-entered text from the display.

Field A/B

Press the **Superkey** and this key to select among three settings that vary the clarity of the VCR freeze-frame image. A VCR freeze-frame image is composed of two video fields. **Field A/B** cycles among field A, field B, and the video frame. After pressing the **FREEZE** control, you must press **STOP** on the VCR (or the **STOP** softkey) to use the **Field A/B** key to select the A or B fields or frame.

Graphics

Press the **Superkey a**nd this key temporarily removes the graphics from the captured review images.

Home

Positions the cursor at the home position. See **Set Home**.

MeanTr

Press the **Superkey** and this key to turn on or off the display of the High Q mean trace on the Doppler display.

Microphone

Turns the microphone on or off.

Page →

Pages through the review images and the patient report.

Page ←

Pages through the review images and the patient report.

Patient Data

Displays or removes the **Patient Data Entry** form.

Print Local

Press the **Superkey** and this key to print with an internal printer or store an image. The **Use Print Button To** setup in the **Image Management** setups determines the function of the **Print Local** key. With the DVS option, it initiates a print with an internal printer.

Pwr Bg

Press the **Superkey** and this key to turn on or off the background of the Power imaging overlay.

Quick Save

Saves the current system settings as a user-defined preset for the active scanhead and clinical option.

Report

Displays or removes the patient report.

Return

Moves the cursor to the next line on the video display.

Scanhead

Displays the **Scanhead** display.

Set Home

Press the **Superkey** and this key to establish a home position for the currently active annotation cursor. The cursor will appear in this location each subsequent time that it is activated using the **Text**, **Text A–D**, **Title**, or **Body Marker** keys. Press **Shift** and this key to annotate the image display at the cursor location with an arrow that points down.

Setups

Displays the **Directory of Setup Options**, which contains several categories of setups based on your system configuration: **Display**, **Peripherals**, **Image Management**, **Annotation**, **Calculations**, **Physio**, **Acquisition Parameters, Measurements**, and **Tissue Specific Presets**. There are also selections for **Temporary Options a**nd **Diagnostics.**

Shift

Press this key and another key on the keyboard to display the upper or lower case character or the alternate character assigned to that key.

SH Pos

When the annotation cursor is displayed, press this key to move the annotation cursor to the right. When the body marker is displayed, press the **Superkey** and the **SH Pos** key to display the scanhead position marker; use the trackball to change the orientation of the scanhead position marker. Press again to remove the scanhead position marker. Press **Shift** and this key to annotate the image display at the cursor location with an arrow that points to the right.

Simult

Press the **Superkey** and this key to start and stop simultaneous mode.

Spacebar

Moves the cursor to the right.

Speed

Press the **Superkey** and this key to change the scrolling sweep speed.

Superkey

Press this key and another key to activate a function or change a display parameter. The keys that are used with the **Superkey** are distributed throughout the keyboard.

Suspend Protocol

With the DVS option, press the **Superkey** and this key to suspend the active acquisition protocol. Press it a second time to resume the acquisition protocol.

Text A, B, C, D

Press these keys to display a pre-defined, application-specific annotation. Each of these keys can have a list of pre- or user-defined annotation assigned to it, which you can cycle through and display.

Text

Press this key to enable text-entry onto the image display. Initially, the cursor appears in the left side of the display in the text home position.

Title

Press this key to enter a title onto the image display. The cursor appears in the upper left corner in the title home position, and two lines of text can be entered in this area.

TI Help

Press this key to display a help screen that briefly describes the TI and MI values.

TI

Press the **Superkey** and this key to cycle between **TIs** and **TIb**. For more information about the output display, press the **TI Help** key or refer to the “Safety” section of the *Scanheads and Safety* manual.

Tr Dir

Press the **Superkey** and this key to select the trace direction for High Q Automatic Doppler measurement, above, below, or above and below the baseline.

Video

Press the **Superkey** and this key to change the video source for the system video monitor. Pressing this key cycles through the video sources, which are determined by your **Peripherals** setups.

Main Chassis

The controls on the main chassis are the circuit breaker and the **ON/STANDBY** switch (Figure 2–6).

Circuit Breaker

Located on the back of the system, the circuit breaker is used to switch power to the system on (standby) or off.

ON/STANDBY

Located on the left side of the system, the **ON/STANDBY** switch turns the system to on or standby.

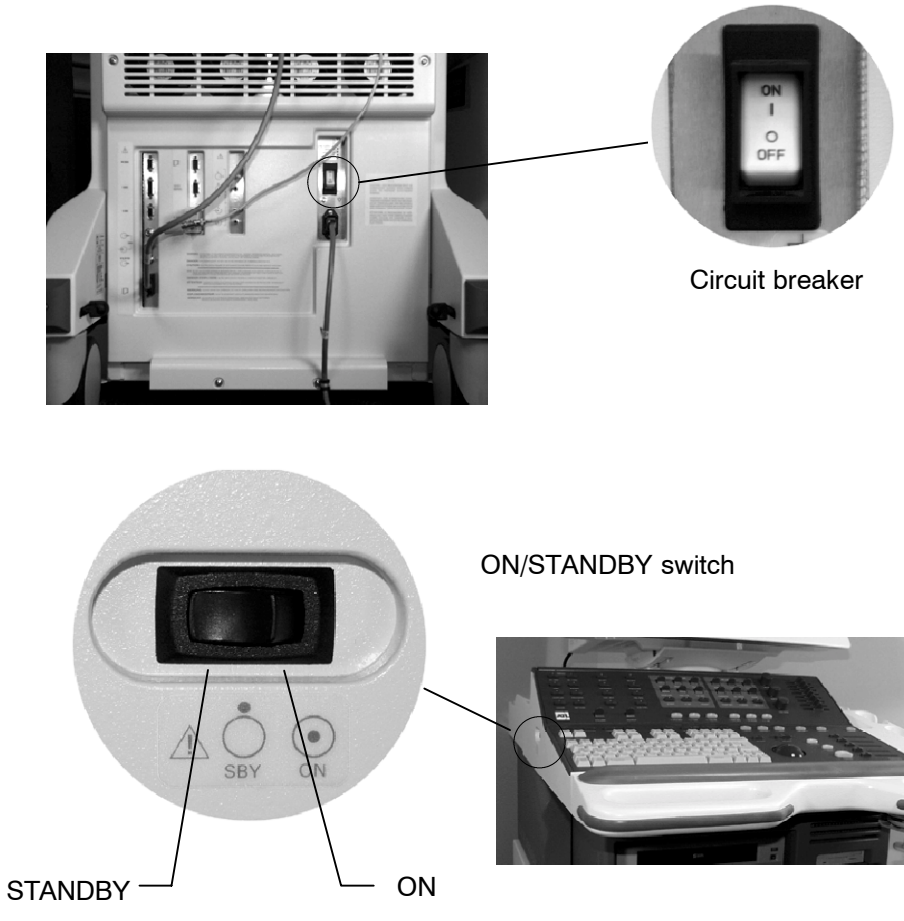


Figure 2–6. Main Chassis Controls

Setups

Introduction

Setups are system parameters. There are three types of setups: system setups, Tissue Specific preset setups, and software setups. Changing any setup takes effect immediately. System setups are saved through a power cycle. Tissue Specific preset setups are only in effect until the current Tissue Specific preset is changed or a power cycle occurs. Tissue Specific preset setups can be saved as part of a user-defined Tissue Specific preset using the **Quick Save** key. Software setups allow an ATL Ultrasound representative to install a system feature temporarily for demonstration purposes.

Clinical Options and Tissue Specific Presets

The clinical options are broad areas of medical study. On the **Scanhead** display, there is a list of clinical options. Additionally, the clinical options are associated with one or more Tissue Specific presets (Figure 3–1). For example: within the small parts clinical option, the Tissue Specific presets are thyroid, testicle, breast, and superficial. If you select the small parts clinical option, these Tissue Specific presets will be displayed on the **Scanhead** display for your selection. An appropriate measurement protocol is also available, from the **CALCS** control, based on the clinical option selected.

You specify how the system will be set up for operation by selecting a clinical option and a Tissue Specific preset. The more specific you are about your intended use of the system, the more you can take advantage of Tissue Specific imaging.

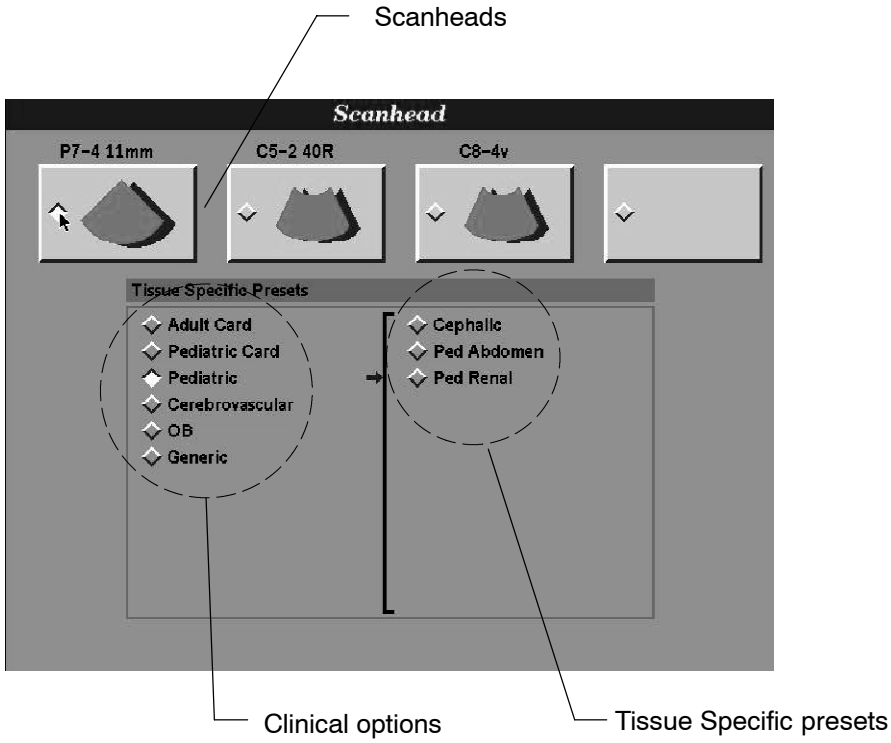


Figure 3–1. Clinical Options and Tissue Specific Presets: Scanhead Display

Scanheads and Tissue Specific Presets

You optimize the system for imaging when you select a Tissue Specific preset. You can also create your own Tissue Specific imaging presets. The **Quick Save** key provides this capability (Figure 3–2). You create a preset name for your optimized preset. Once you associate the scanhead with the current system settings by saving them, from this point on, that scanhead will be associated with an optimized preset, and the preset name appears on the **Scanhead** display. If you do not enter a name, and then save the current system settings, a system default name will be used to identify the Tissue Specific preset, for example: Custom X.

Once you have saved a preset in this way, each time that you press the **Scanhead** key, the list of Tissue Specific presets for a scanhead type will include your custom preset. You can choose presets, save presets to a disk, retrieve presets from a disk, select a power-up clinical option, and transfer presets between systems.

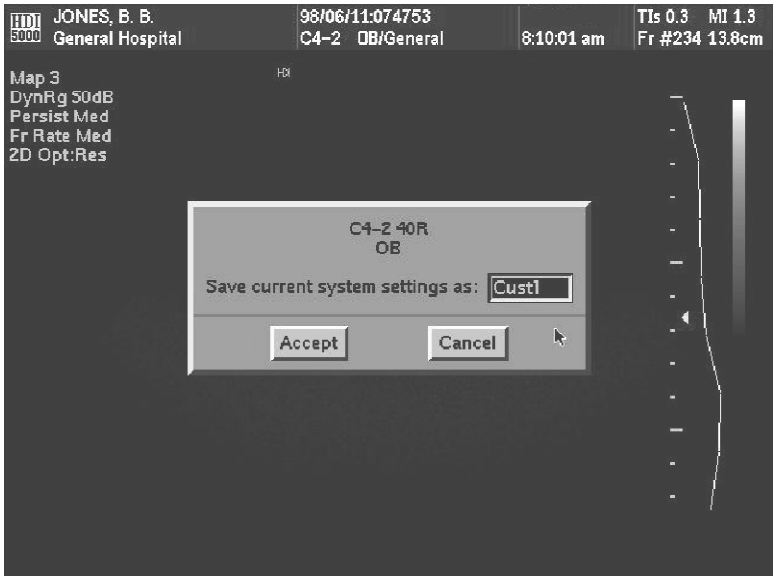


Figure 3–2. Quick Save for Creating a Preset

Directory of Setup Options

The **Setups** key displays the **Directory of Setup Options** (Figure 3–3), which lists system setups, Tissue Specific preset setups, and software setups. The directory is based on your system configuration and will vary accordingly. All of the setups are explained in the glossary.

When you select from the directory, a list of the setups for that option appears on the screen. You can select the values for the setups. The **Diagnostics**, **Close**, and **Arrow** (left and right) buttons at the bottom of the display allow you to use the system diagnostics, close the directory, or move through the directory.

Changes to setups are saved when power is switched off, or by entering new patient data, except for the Tissue Specific preset setups, which are reset when the Tissue Specific preset is changed.

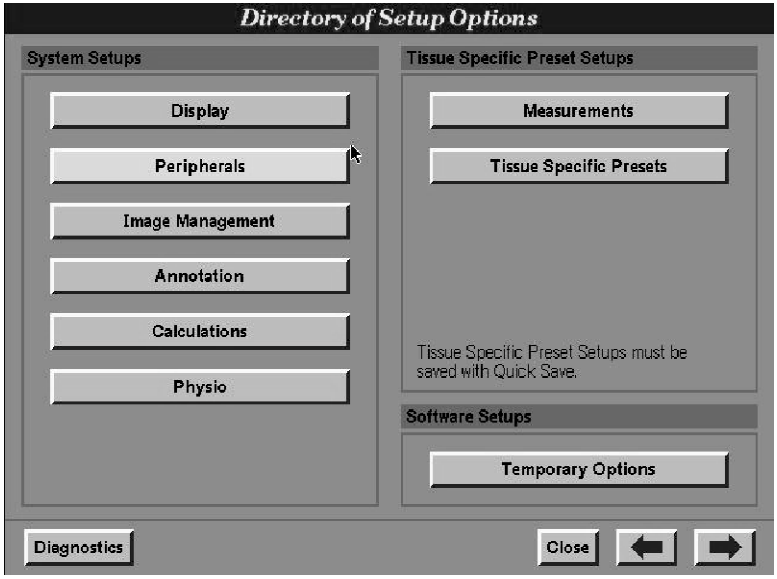


Figure 3–3. Directory of Setups Options (Example)

System Setups

System setups comprise the **Display**, **Peripherals**, **Image Management**, **Annotation**, **Calculations**, **Physio**, and **Acquisition Parameters** setups. Depending upon your system configuration, you will have all or some of these available in your directory.

Display Setups

Display setups cover a range of system parameters related to the screen header, display, and measurements (Figure 3–4).

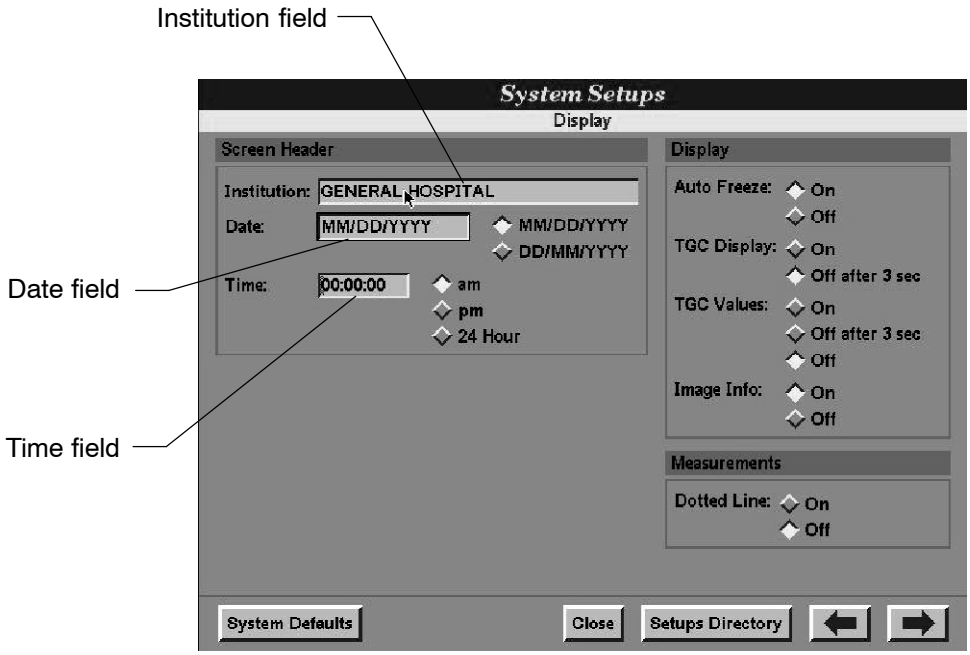


Figure 3–4. Display Setups

Peripherals Setups

Peripherals setups are related to the selection and setup of internal or external printing or recording devices for use with the system. You can also turn the speakers and the VCR frame counter on or off (Figure 3–5).

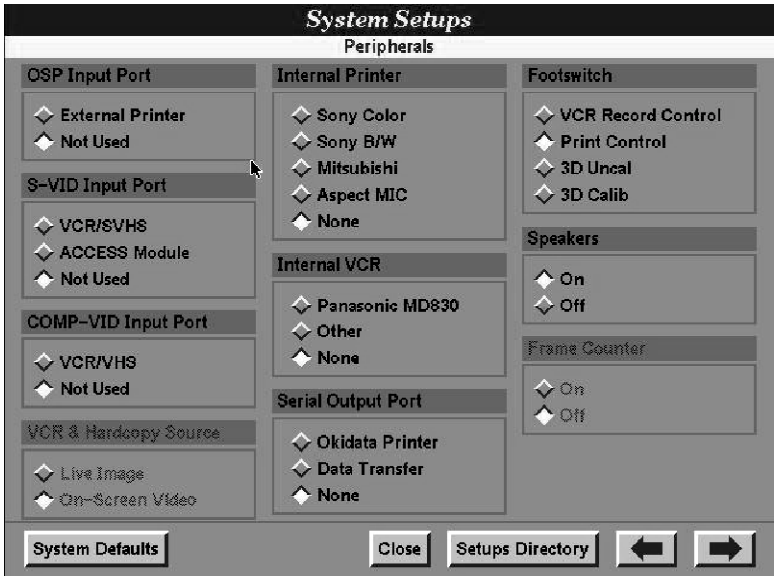


Figure 3–5. Peripherals Setups

Image Management Setups

Image Management setups are related to the selection and setup of the system and Image Management devices for Worklist, DiskLink, NetLink, WebLink, and Digitial Video Streaming operation. Depending upon your system configuration, the appropriate directory of setup options is displayed (Figure 3–6).

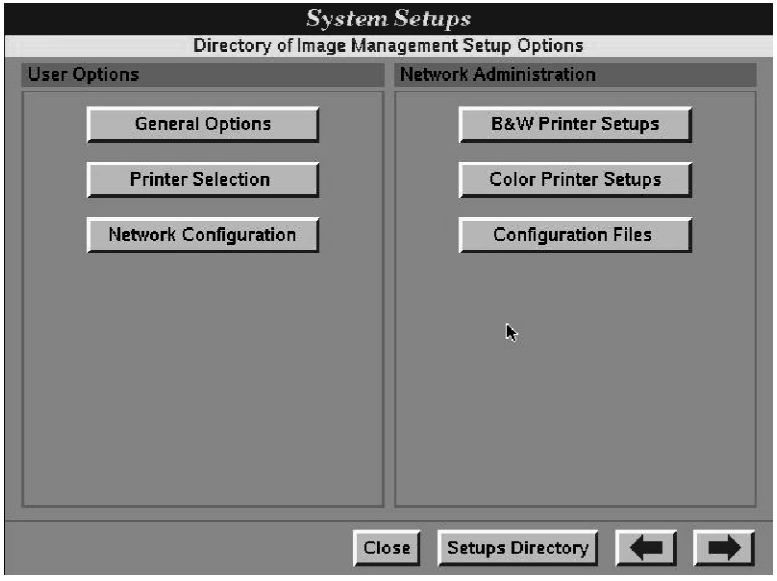


Figure 3–6. Directory of Image Management Setup Options (Example)

Annotation Setups

Annotation setups provide the capability to customize the **Text A**, **B**, **C**, and **D** keys. For a Tissue Specific or custom preset, you can create a list of specific terms that you might want to use during an exam (Figure 3–7) and assign them to one of the four **Text** keys. Once created in Setups, these terms are available during an exam by pressing the **Text** key to which you assigned them.

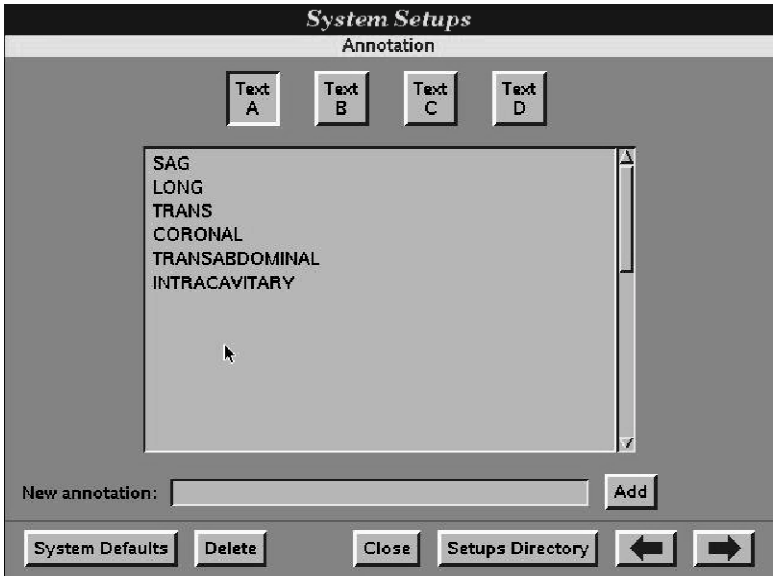


Figure 3–7. Annotation Setups

Calculations Setups

Calculations setups include **Analysis** and **General Cardiology** setups (Figure 3–8).

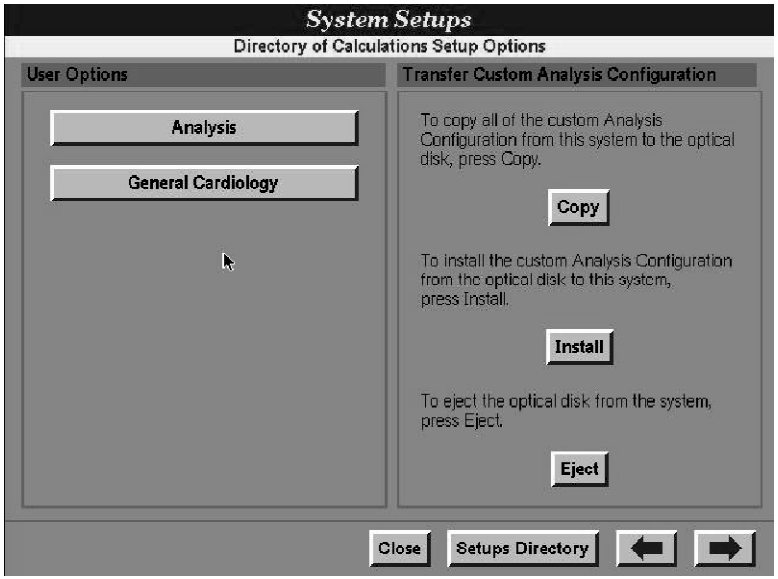

System Setups
Directory of Calculations Setup Options
User Options
Analysis
General Cardiology
Transfer Custom Analysis Configuration
To copy all of the custom Analysis Configuration from this system to the optical disk, press Copy.
Copy
To install the custom Analysis Configuration from the optical disk to this system, press Install.
Install
To eject the optical disk from the system, press Eject.
Eject
Close
Setups Directory

Figure 3–8. Directory of Calculations Setup Options Display

Analysis

Each measurement, calculation, table, and equation has characteristics that can be viewed or modified by using system setups. The **Calculations: Analysis** display is the main menu for configuring analysis and is used to view the current configuration (Figure 3–9). The left side, labeled **Current Configuration**, has the list of protocols, calculations, and measurements that you can select for viewing. The selections on the **Calculations: Analysis** display have grayed–out labels when they are not available. The selection you make under **Current Configuration** determines the selections that are available. Compare the displays in Figure 3–9:

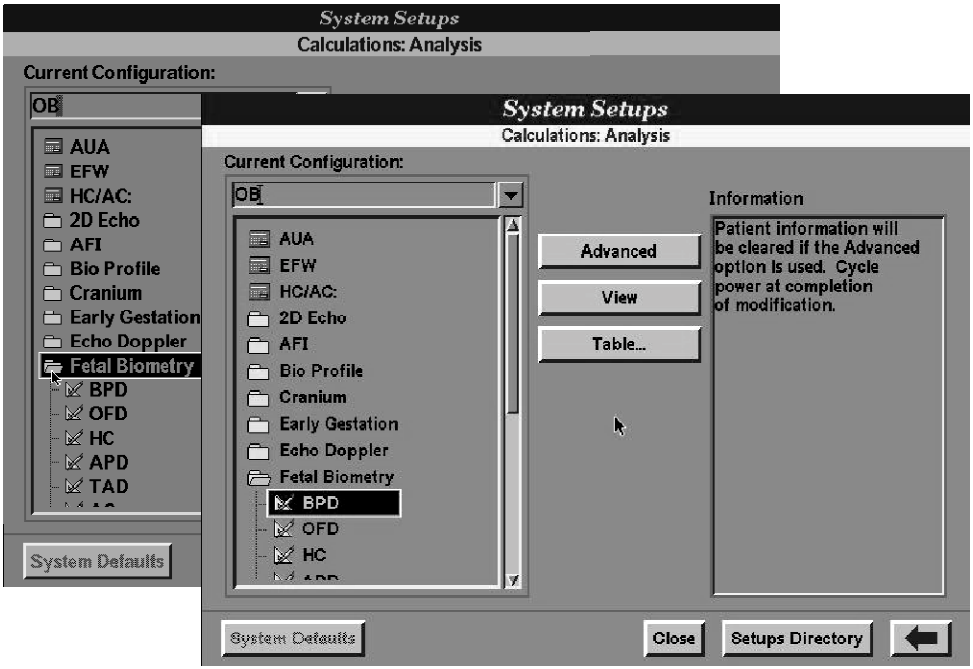


Figure 3–9. Current Configuration

- In the example with **Fetal Biometry** highlighted, there is an expanded list of measurements under the protocol **Fetal Biometry**.
- In the example with **BPD** highlighted, BPD is a measurement option in the protocol **Fetal Biometry**. With BPD highlighted, the selections **Advanced, Views,** and **Table** are all selectable. For example, if **Table** is selected, a table can be viewed, edited, and configured. Other **Current Configuration** selections can make a different set of selections appear.

Calculation Analysis Display Conventions

Icons that appear on the **Current Configuration** list are as follows:

- indicates a measurement.
- indicates a calculation, which may have a table.
- indicates a protocol
- indicates a protocol opened to display its measurements.

" **To view an analysis configuration:**

1. Press the **Setups** key. The **Directory of Setup Options** appears.
2. Select **Calculations**. The **Directory of Calculations Setup Options** appears.
3. Select **Analysis**. The **Calculations: Analysis** display appears (Figure 3–9). The analysis options are listed under **Current Configuration**.
4. Highlight one of the options from the list under **Current Configuration. (BPD** is highlighted in Figure 3–10.)
5. Select **View**.
   - If a measurement option is highlighted, the **View Measurement** dialog box appears (Figure 3–10).
   - If a calculation option is highlighted, the **View Calculation** dialog box appears (Figure 3–11).

Note *When a protected calculation or other element is selected, the **Save** and **Delete** selections are grayed out to prevent corruption of standardized calculations and measurements supplied with the analysis enhancements.*

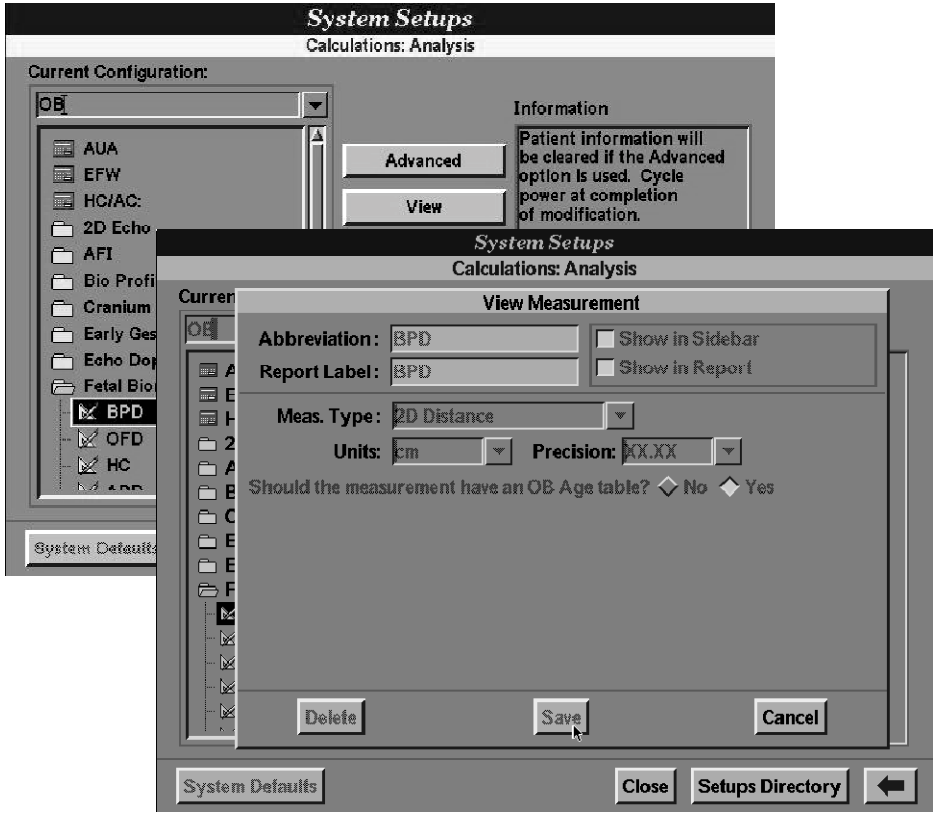


Figure 3–10. View Measurement

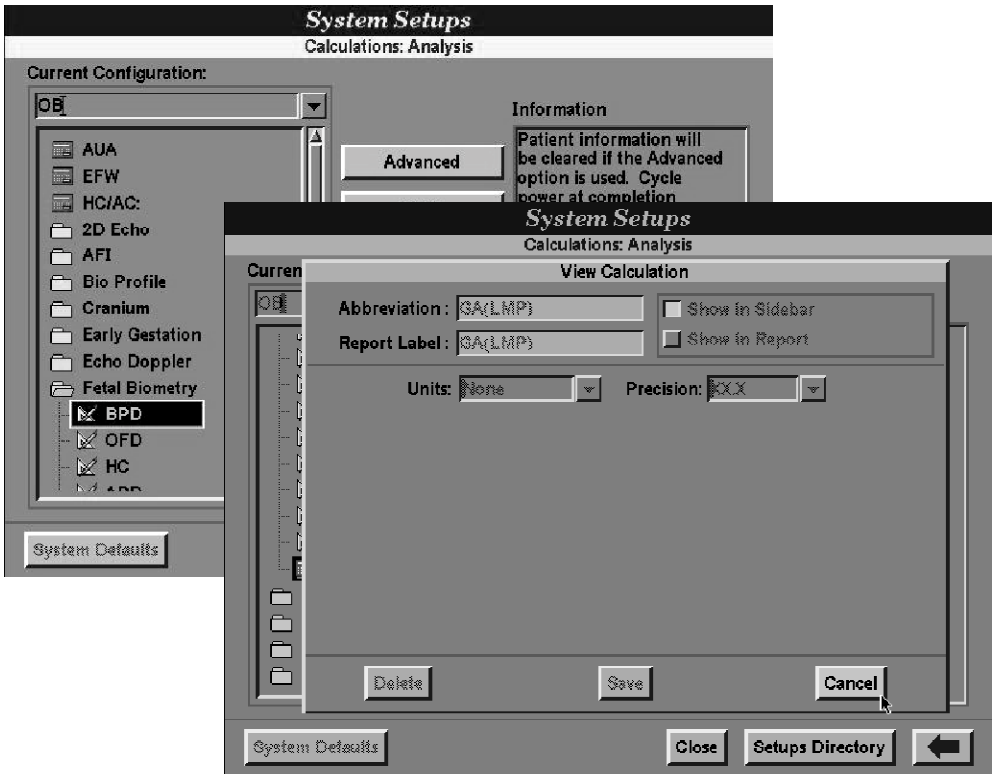


Figure 3–11. View Calculation

Calculations Analysis Configuration Display

Configuring Calcs protocols is accomplished in the **Calculations: Analysis** display in system setups, which has a set of displays used to configure your system for automatic analysis and reporting. When configured, each study type or an individual patient exam has its analysis tools ready when you press the **CALCS** control.

The **Calculations: Analysis** display is composed of a configuration list, a measurements list, a set of control selections, a drop–down clinical options list, and several hidden dialog boxes that appear as you need them. The hidden dialog boxes are used to modify calculations, measurements, and protocols.

" **To access configuration displays and selections:**

1. Press the **Setups** key. The **Directory of Setup Options** appears.
2. Select **Calculations**. A **Directory of Calculations Setup Options** appears (Figure 3–12).

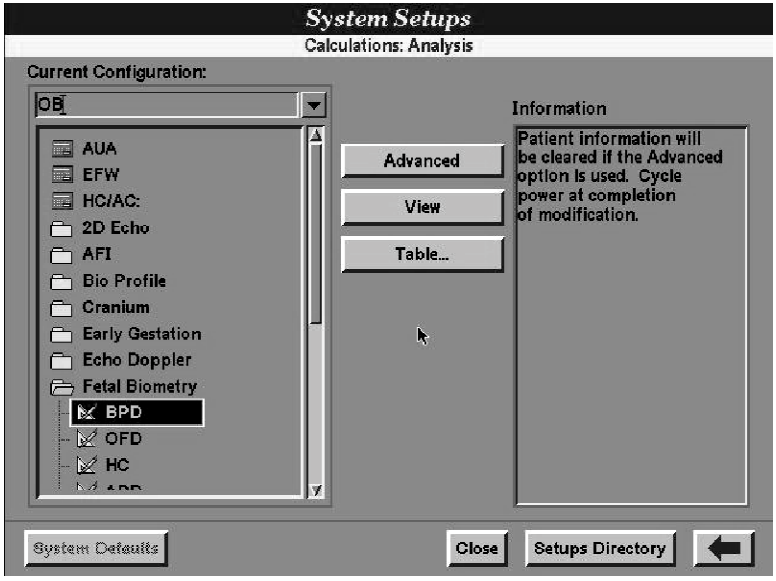


Figure 3–12. Calculations: Analysis Display

3. Select **Analysis**. The **Calculations: Analysis** display appears (Figure 3–12). From this display you can view a list of measurements, calculations, and protocols under **Current Configuration**.
4. Use the drop-down clinical options list to view the clinical options.
5. Select a clinical option. The clinical option appears in the text field. A new list of protocols related to your selection appears under **Current Configuration**.
6. Double-select an item on the list under **Current Configuration**. The list expands, and new selections appear based on your selection.
7. Highlight a measurement. More selections appear.
8. Select **Advanced** to display the **Global Measurement List**, which contains measurements that can be added to the list of measurements for a protocol (Figure 3–13).

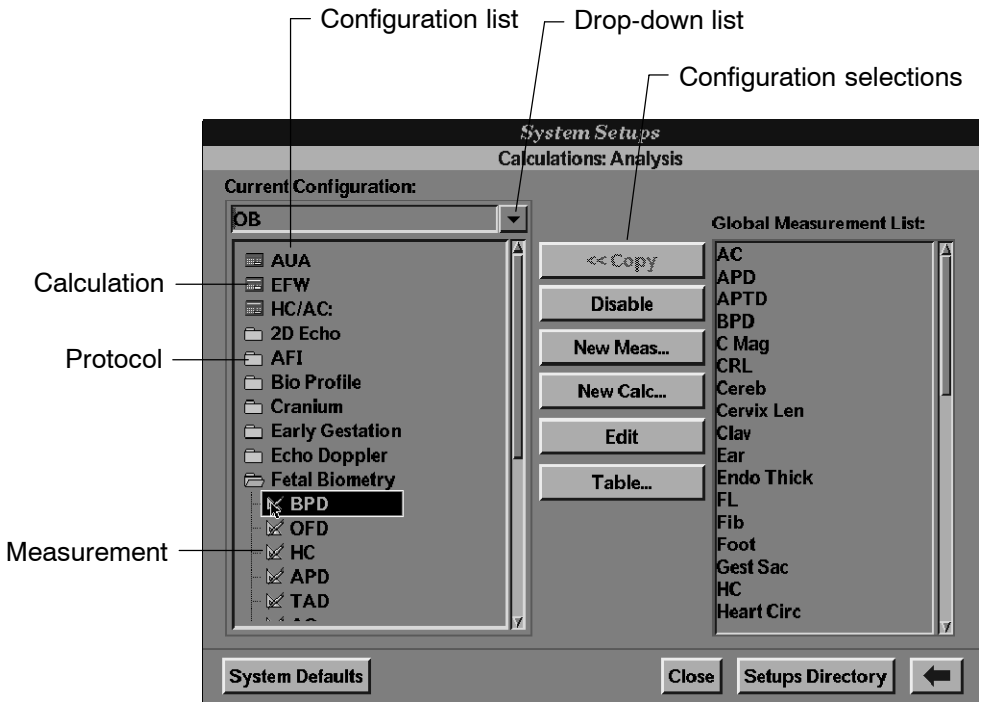


Figure 3–13. Calculations: Analysis Display Selections

Calculations Analysis Selections

Selections on the **Calculations: Analysis** display are available as needed to accomplish a configuration task. They are available for selection when visible and not grayed out. To assist in describing the selections, the **Fetal Biometry** protocol is illustrated here because it has the most selections of any protocol. The selections are described as follows (Figure 3–13):

- Under **Current Configuration** is a list of measurements, calculations, and protocols. The **Calculations: Analysis** display selections change as you make selections on the **Current Configuration** list.
  - Double-select a protocol to expand the **Current Configuration** list, gain access to configuration selections, and to view measurements and calculations.
  - Select a calculation for access to **Edit** and **Table** selections, to edit a calculation or table.
  - Select a measurement to edit or delete a measurement.
  - Items not grayed out in the configuration list display on Calcs menus when you press **CALCS** during exam.

- Selecting the drop-down list displays a list of clinical options. When a clinical option is highlighted on the list, it appears in the text field. The **Current Configuration** list changes to include protocols, measurements, and calculations available with the chosen clinical option.
- You can copy items from the **Global Measurement List** into protocols under **Current Configuration**. Highlight a protocol and select **Advanced** to display the **Global Measurement List**.
- Configuration selections include the following:
  - Select **Copy** to copy a global measurement to a selected protocol. When copying is completed, **Cancel Copy** changes to **Disable/Enable**.
  - Select **Cancel Copy** to cancel a copy selection. **Cancel Copy** only appears immediately after **Copy** is selected, during the data transfer time.
  - Select **Disable/Enable** to turn a measurement or calculation off or on in a protocol. When you disable an entry, it changes color on the **Current Configuration** list and is removed from the Calcs protocol list.
  - Select **New Meas** to create a measurement that is not in a protocol and is not available in the global measurement list. When a new measurement is created, it appears on the expanded protocol list when the protocol is double-selected.
  - Select **New Calc** to create a new calculation or equation.
  - Select **Edit** to modify a measurement or calculation. **Edit** is grayed out unless a measurement or calculation in the **Current Configuration** list is highlighted.
  - Select **Table** to modify or add a table or new equation. This selection is grayed out until an item that uses a table or equation is highlighted on the **Current Configuration** list.

Configuring CALCS

" **To copy a measurement or a calculation to a protocol:**

1. Access the **Calculations: Analysis** display as described in "To access configuration displays and selections."
2. Highlight or double-select the protocol to which you want to copy the measurement.
3. Select **Advanced**. The **Global Measurement List** appears.
4. On the **Global Measurement List**, highlight the measurement you want to copy. **Copy** and **Cancel Copy** selections appear (Figure 3–14).
5. Select **Copy**. The **Cancel Copy** selection remains while the system copies the measurement to the protocol. When the copying is complete, the measurement appears at the bottom of the protocol's measurement list, and **Cancel Copy** changes to **Enable/ Disable**.

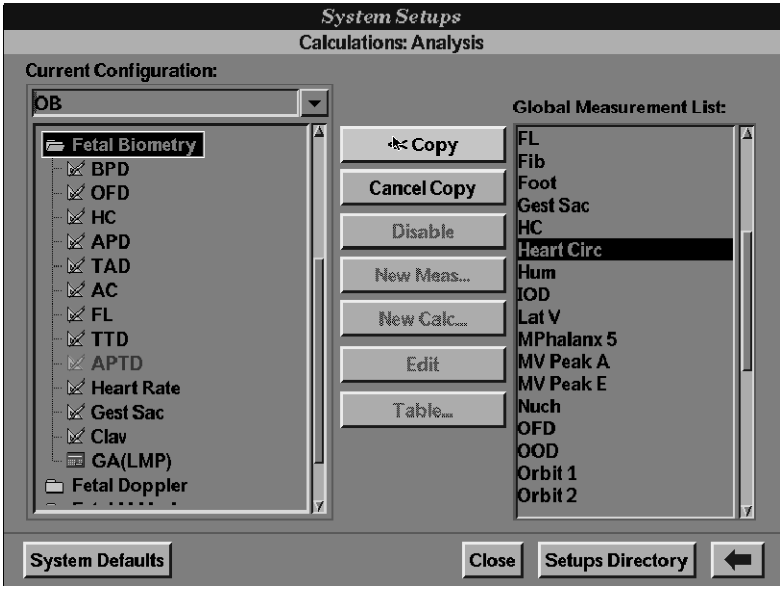


Figure 3–14. Copy and Cancel Copy Selections

" **To delete a measurement or calculation from a protocol:**

Some measurements and calculations are protected from being deleted. **Delete** is grayed out for entries that are protected.

1. Access the **Calculations: Analysis** display as described in "To access configuration displays and selections."

2. Double-select the desired protocol folder to expand the protocol list to view the measurement level. Example: The **Fetal Biometry** folder expands to display several measurements and calculations that are part of the protocol labeled **Fetal Biometry** (Figure 3–15).
3. Highlight the item you want to delete.
4. Select **Edit**. The **Edit Measurement** or **Edit Calculation** dialog box appears (Figure 3–15).
5. Select **Delete**. A message appears, “Deleting data. Please wait...,” and the highlighted item is deleted from the list. The display returns to the **Calculations Analysis** display.

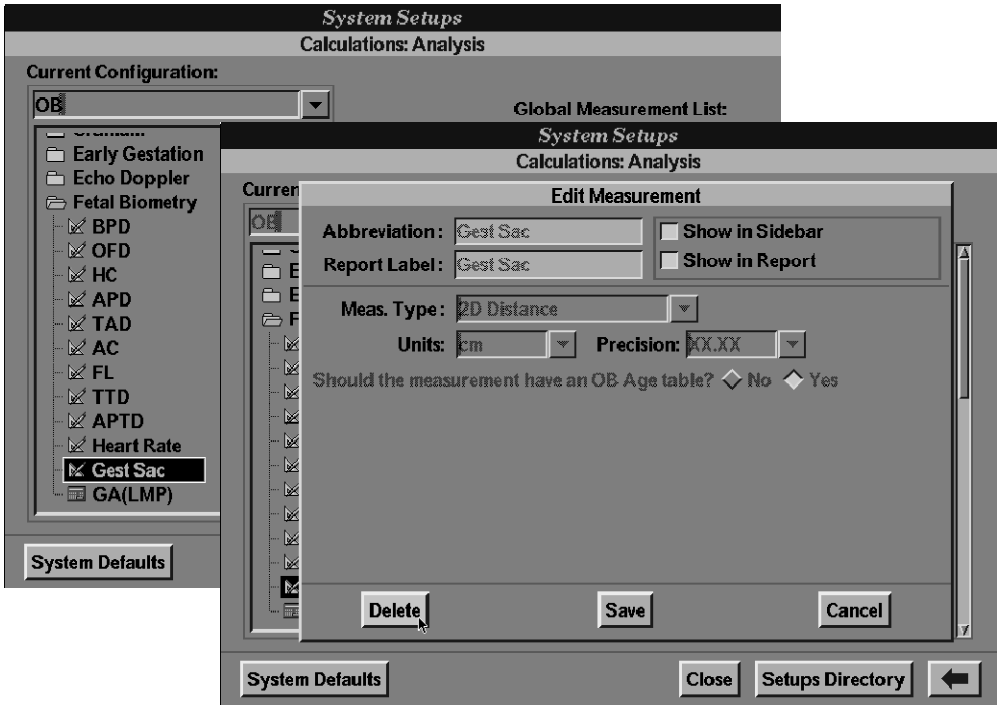


Figure 3–15. Deleting a Measurement

" **To disable a measurement from displaying on the protocol list:**

1. Access the **Calculations: Analysis** display as described in “To access configuration displays and selections.”
2. Highlight a measurement or a calculation on the **Current Configuration** list.

3. Select **Disable**. The selected measurement or calculation is grayed out and does not appear on the protocol list during an exam. (To enable a measurement or calculation that has been disabled, repeat step 2, and select **Enable**.)

" **To edit a calculation or measurement:**

1. Access the **Calculations: Analysis** display as described in "To access configuration displays and selections."
2. Highlight a protocol folder. The **Current Configuration** list expands to display measurements and calculations.
3. Highlight the item you wish to edit.
4. Select **Edit**. An **Edit Measurement** or **Edit Calculation** dialog box is displayed (Figure 3–16).
5. Modify the data fields and selections as needed in the dialog box.
6. Select **Save**. A message, "Saving data. Please wait..." appears and then the **Calculations: Analysis** display appears. All modifications are saved.

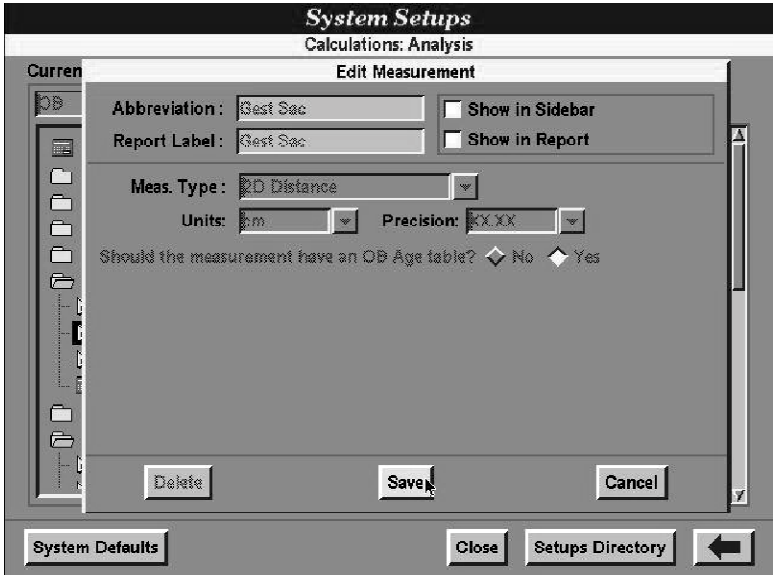


Figure 3–16. Editing a Measurement

" **To define a new measurement:**

1. Access the **Calculations: Analysis** display as described in "To access configuration displays and selections."
2. Highlight the protocol to which you want to add your defined measurement.
3. Select **New Meas**. A **New Measurement** dialog box appears (Figure 3–17).

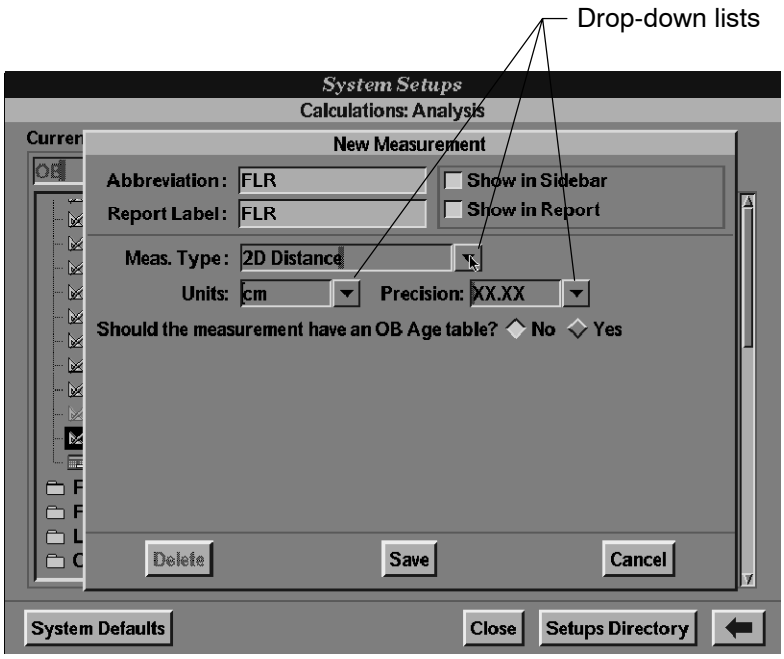


Figure 3–17. Defining a New Measurement

4. Type in a new abbreviation and report label.

Note *The labels must be unique to the new measurement; they cannot duplicate labels used in protocols and global measurements.*

5. Select the **Meas. Type** drop-down list. A measurement list with a scroll bar is displayed.
6. Select the desired measurement. Your selection appears in the **Meas. Type** text field.
7. For **Units** and **Precision** select the drop-down lists.
8. Select the desired **Units** and **Precision** settings.

9. Set the other settings in the dialog box to your preference.
   - **Show in Sidebar** refers to the Calcs menu that you see after pressing **CALCS** during imaging. If you want to see your new measurement in the Calcs menu, you must select **Show in Sidebar**.
   - **Show in Report** must be selected if you want your new measurement to be in the patient report.
   - Answer the question, “Should the measurement have an OB Age table?”
10. Select **Save**. The measurement is saved and appears in the **Current Configuration** list.

" **To define a new calculation:**

1. Access the **Calculations: Analysis** display as described in “To access configuration displays and selections.”
2. Select **New Calc**. A **New Calculation** dialog box appears (Figure 3–18).
3. Type in the **Abbreviation** and **Report Label.**

Note *The labels must be unique to the new calculation; they cannot duplicate labels used in protocols and global measurements.*

4. For **Units** and **Precision** select the drop-down lists.
5. Select the desired **Units** and **Precision** settings.
6. Set the other settings in the dialog box.
   - **Show in Sidebar** refers to the Calcs menu that you see after pressing **CALCS** during imaging. If you want to see your new measurement in the Calcs menu, you must select **Show in Sidebar**.
   - **Show in Report** must be selected if you want your new measurement to be in the patient report.

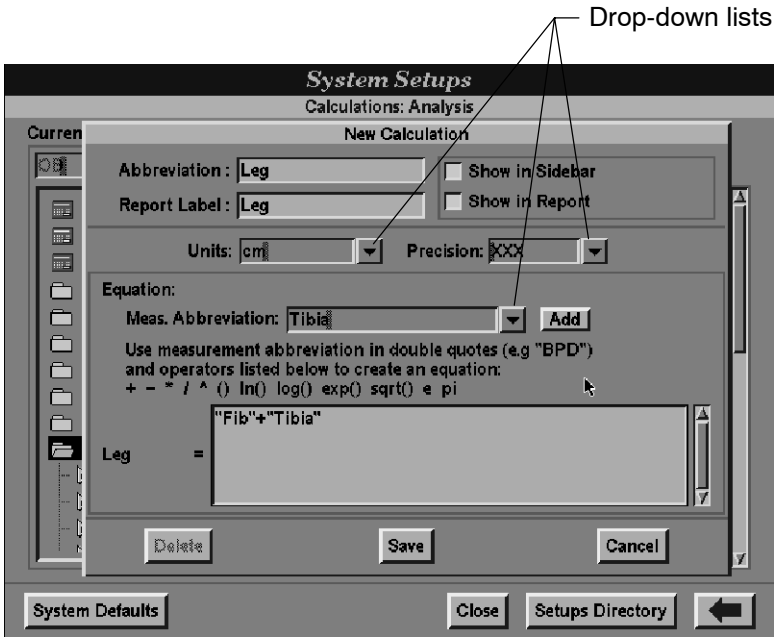


Figure 3–18. Defining a New Calculation

7. Move the cursor to the place in the equation field where you want to insert abbreviations or characters. Press **SELECT**. A flashing text cursor appears at the insertion point in the equation field.
8. Combine typed characters and mathematical operators and the required measurement abbreviations to create the new equation:
   - For mathematical operators, use the conventions listed on the display.
   - To enter abbreviations, select the drop-down list to view the **Meas. Abbreviation** list. Highlight the desired abbreviation. Press **SELECT**. Your choice appears in the **Meas. Abbreviation** field. Select **Add**. The abbreviation appears at the insertion point.
9. When the equation is correctly entered, select **Save**. The dialog box disappears, and the display returns to the **Calculations: Analysis**. The new calculation is added to the bottom of the list of measurements for the selected protocol (Figure 3–19).

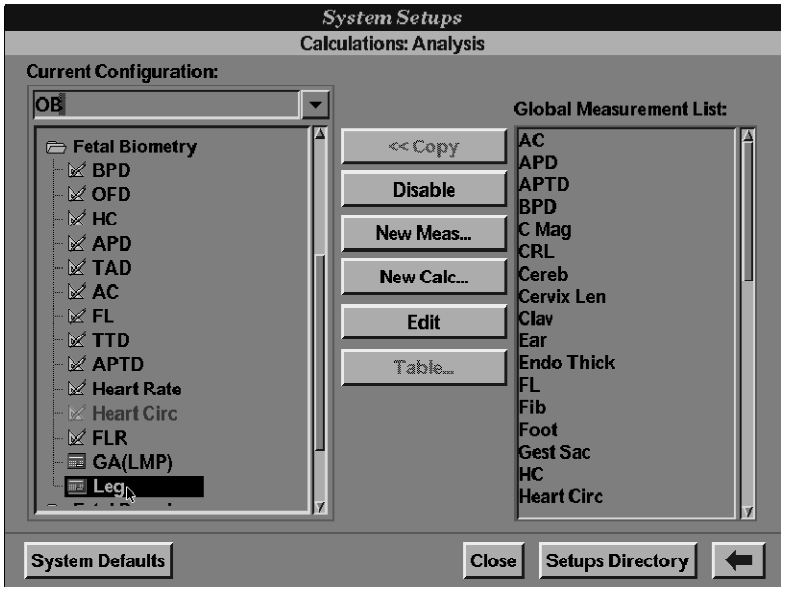


Figure 3–19. New Calculation

OB Tables and Equations

Analysis can be configured with customized or standard tables and equations.

" **To configure fetal growth and fetal weight tables and equations:**

This procedure chooses one example of a setup to describe the use of display selections. The example adds a table to a patient study on estimated fetal weight (EFW) and uses the Hadlock1 table and equation.

1. Access the **Calculations: Analysis** display as described in "To access configuration displays and selections."
2. Select **OB** from the drop-down list under **Current Configuration**.
3. From the **Current Configuration** list, highlight a measurement that requires a table. **EFW** is highlighted in this example (Figure 3–20).

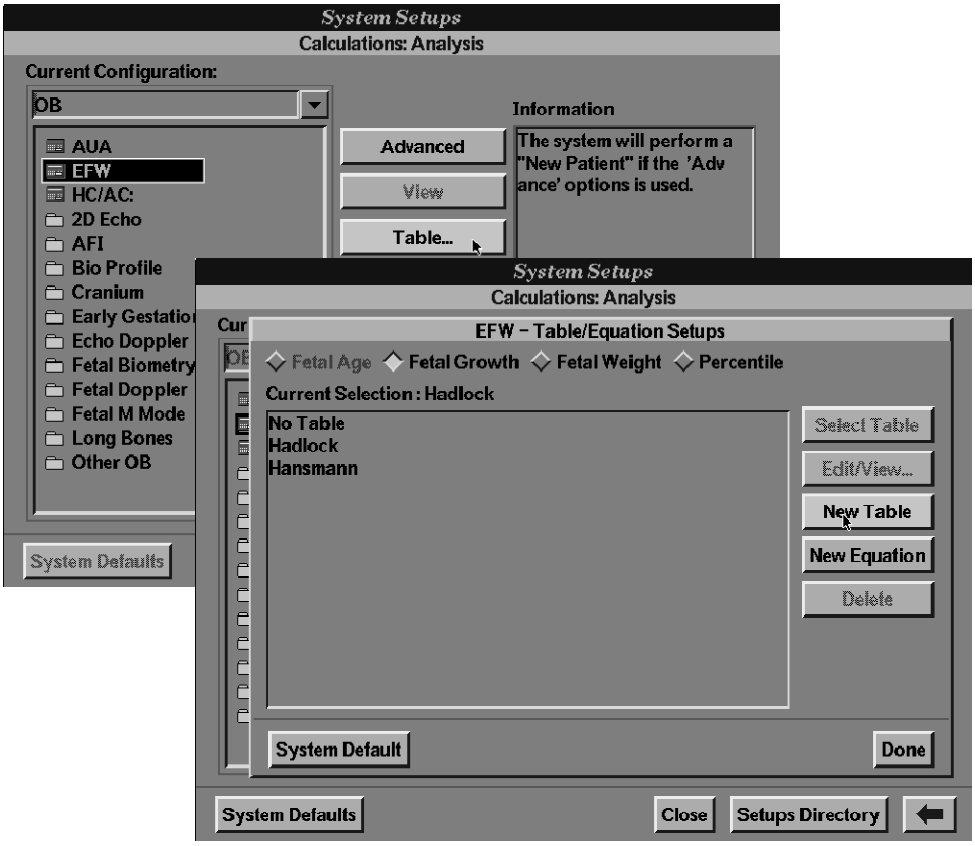


Figure 3–20. EFW Table/Equation Setup

4. Select **Table**. The **Table/Equation Setups** dialog box appears.
5. Across the top of the **Table/Equation Setups** dialog box are selections of **Fetal Age**, **Fetal Growth**, **Fetal Weight**, and **Percentile**. Select either **Fetal Growth** or **Fetal Weight.**
6. At this point you have several options:
   - Select a table or **No Table** from the displayed list: Highlight a table or **No Table** and select **Select Table**. The text field to the right of **Current Selection** displays your selection, and the new table is used in the OB report.
   - Select a user-table and edit its equation: Highlight a table from the list and select **Edit/View**. An equation dialog box appears (Figure 3–21). Edit the equation as described in steps 4–8 of "To define a new calculation."

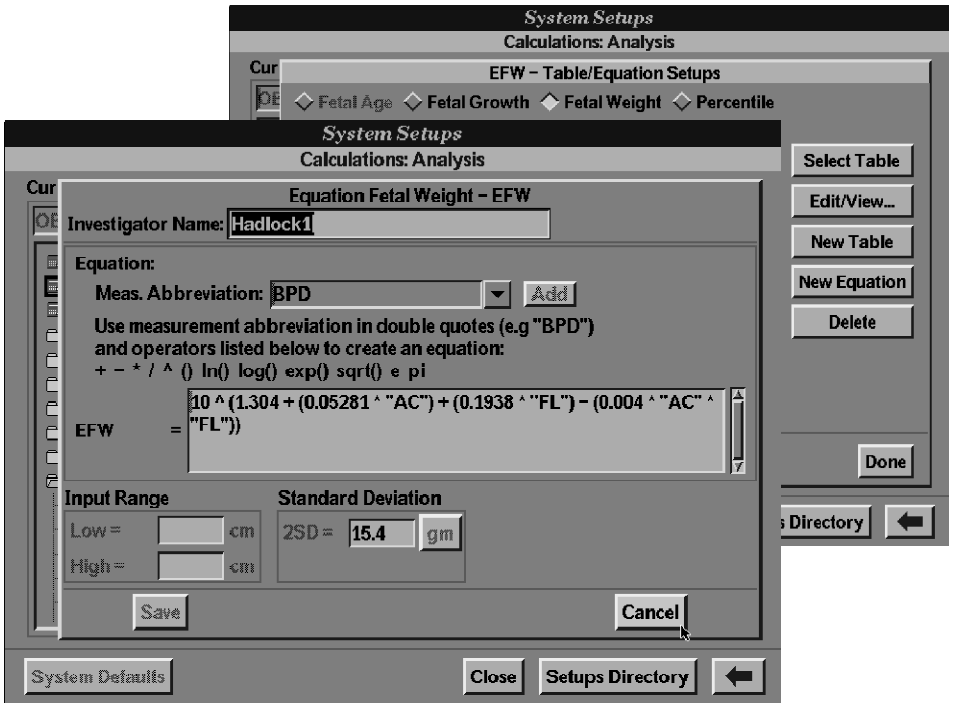


Figure 3–21. Editing or Defining a New Equation

- Define a new table: Select **New Table**. A table dialog box appears with a table template and selections used for designing a table. Select **Save** to save the new table.
- Define a new equation: Select **New Equation**. A new equation dialog box appears (Figure 3–21) with fields and selections used for defining an equation. Select **Save** to save the new equation.
- Delete an item from the list: Highlight the item and select **Delete**. A dialog box appears with the message, “Deleting a current selected table will default the current table selection to ’No Table’.” Select **Continue** to delete the entry. When protected items are selected, a message appears, “This table name cannot be deleted.” Select **OK** to continue.
- Select **System Defaults** to reset the current table to the original ATL settings.

7. Select **Done** when you are satisfied with the changes. The display returns to the main **Calculations: Analysis** display.

" **To configure fetal age tables:**

1. Access the **Calculations: Analysis** display as described in "To access configuration displays and selections."
2. Select **OB** from the drop–down list under **Current Configuration**. **OB** appears in the text field.
3. From the **Current Configuration** list, double-select the desired protocol to access its list of measurements.
4. Highlight the desired measurement and select **Table**. The **Table/Equation Setups** dialog box appears (Figure 3–22).
5. Select **Fetal Age.** A list of table names appears.
6. Select **New Table**. The display **Table: Fetal Age** appears. On the display is a table template and selections used to configure a table (Figure 3–23). Use this template to design your table.
7. When your table is complete, select **Save** to save the configured table for exams and reports.

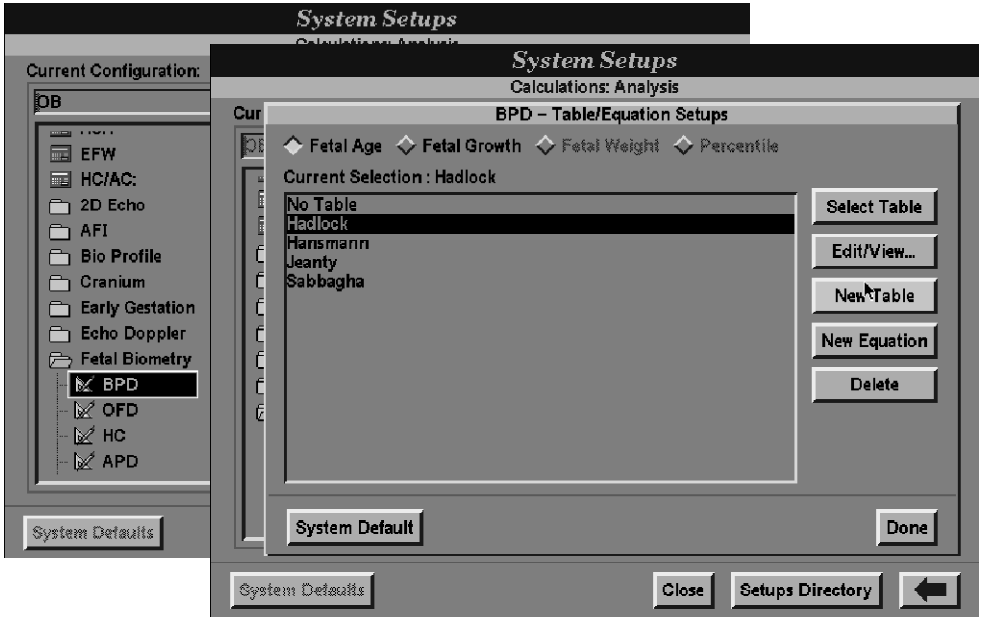


Figure 3–22. Fetal Age Table Setups

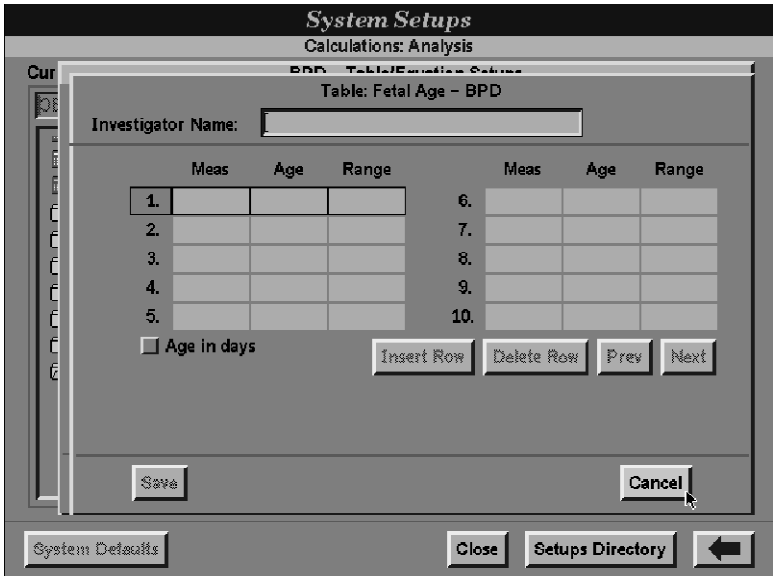


Figure 3–23. Fetal Age Table Configuration Template

Analysis Backup, Transfer, and Restore

You can copy your analysis configuration to an optical disk and keep the disk for backup or use it to transfer the configuration to another system.

" **To copy your custom analysis configuration:**

1. Press the **Setups** key. The **Directory of Setup Options** is displayed.
2. Select **Calculations**. The **Directory of Calculations Setup Options** appears (Figure 3–24).
3. Insert a blank formatted optical disk in the optical disk drive.
4. Select **Copy**. A message indicates copying is occurring. When copying is complete, a message indicates successful copying (Figure 3–24).
5. Select **OK** to remove the message.
6. Press the **Setups** key to exit the directory.

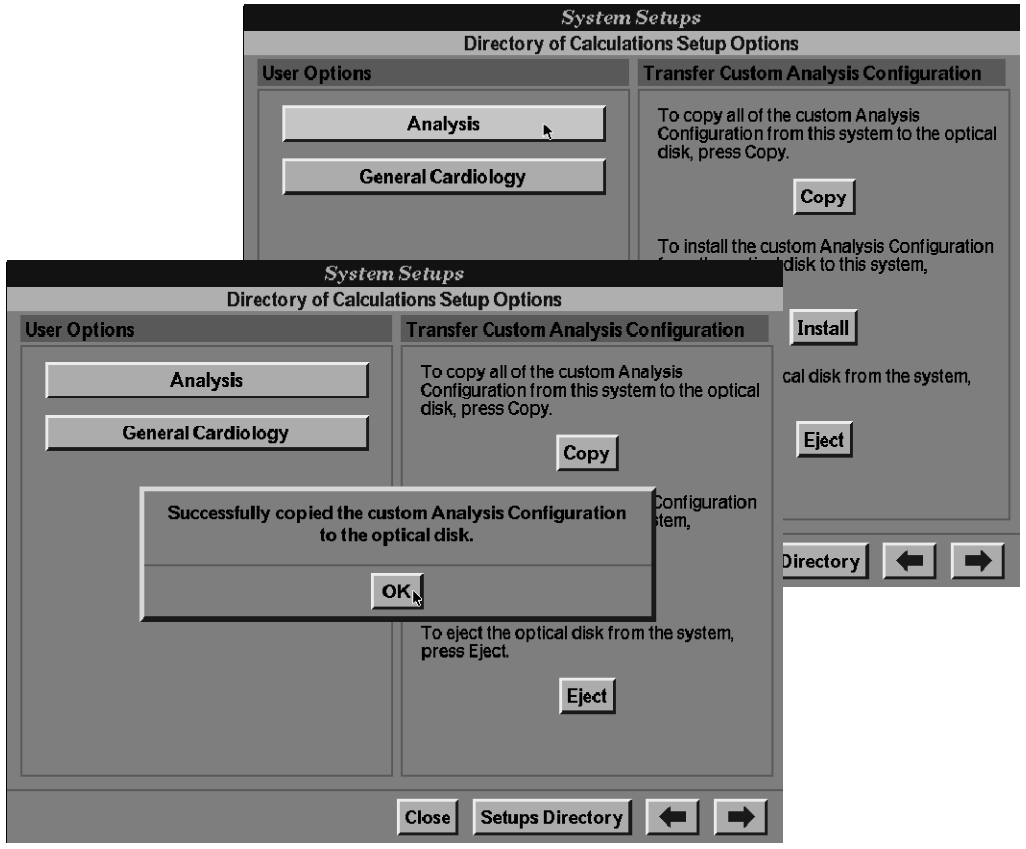

System Setups
Directory of Calculations Setup Options
User Options
Analysis
General Cardiology
Transfer Custom Analysis Configuration
To copy all of the custom Analysis Configuration from this system to the optical disk, press Copy.
Copy
To install the custom Analysis Configuration
disk to this system,
Install
cal disk from the system,
Eject
Directory
System Setups
Directory of Calculations Setup Options
User Options
Analysis
General Cardiology
Transfer Custom Analysis Configuration
To copy all of the custom Analysis Configuration from this system to the optical disk, press Copy.
Copy
Successfully copied the custom Analysis Configuration to the optical disk.
OK
To eject the optical disk from the system, press Eject.
Eject
Close
Setups Directory

Figure 3–24. Copying a Configuration

" **To install your custom analysis configuration:**

1. Press the **Setups** key. The **Directory of Setup Options** is displayed.
2. Select **Calculations**. The **Directory of Calculations Setup Options** appears.
3. Insert the optical disk with your custom analysis files into the optical disk drive.
4. Select **Install**. A dialog box appears asking if you want to copy your new custom analysis files over the existing set (Figure 3–25).
5. Select **OK** to install your new files.
6. Press **Setups** to exit the directory and return to the imaging display.

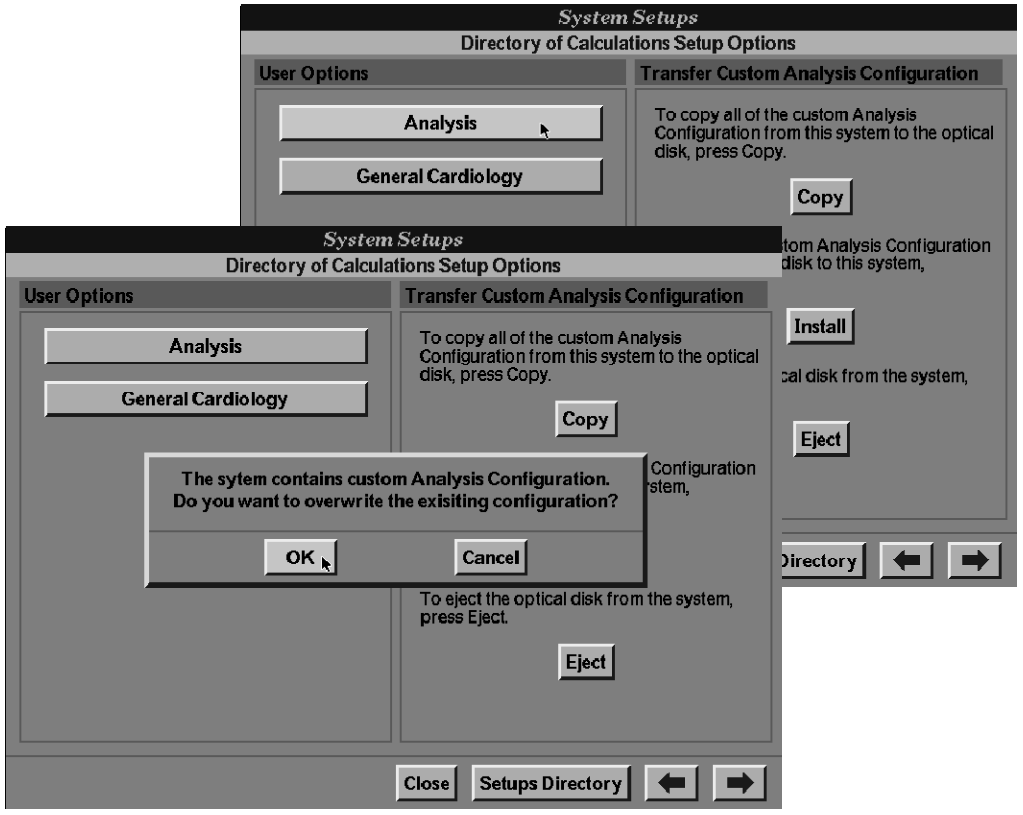


Figure 3–25. Installing a Configuration

General Cardiology

The General Cardiology setups include the **Adult MMode Vol Calc Method** and its options, **Teicholz** and **Cubed**.

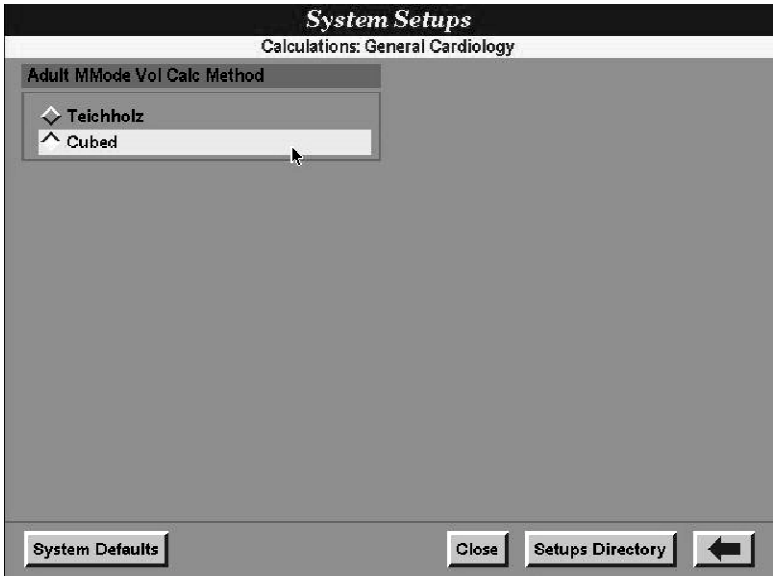


Figure 3–26. Calculations: General Cardiology

Physio Setups

Physio allows you to optimize the system for pulse, phonocardiography, and other auxiliary physio transducers (Figure 3–27).

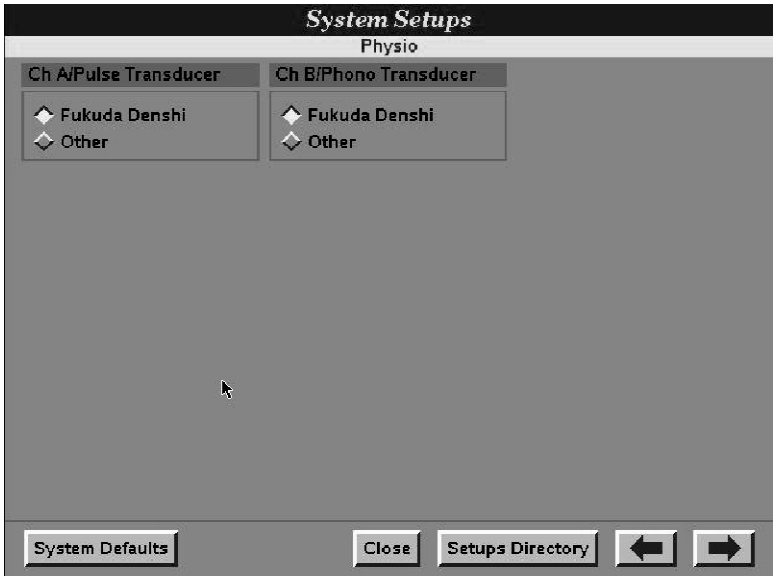


Figure 3–27. Physio Setups

Tissue Specific Preset Setups

Measurements Setups

Measurements setups allow you to select setup options for the following:

- **2D Area Method**: trace by points, continuous trace, or ellipse.
- **Doppler Area Method**: trace by points or continuous trace.
- **Volume Method**: 3 distances, distance and ellipse, or 1 distance method for calculating volume of a shape.
- **Doppler Results Display**: acceleration time, deceleration time, time-averaged mean velocity, peak systolic velocity/frequency, minimum diastolic velocity/frequency, end diastolic velocity/frequency, time-averaged peak velocity/frequency, resistive index, pulsatility index, systolic:diastolic ratio, VTI, peak pressure gradient, and heart rate (Figure 3–28).

  For cardiology applications, the available Doppler results are as follows: peak velocity, peak gradient, mean velocity, mean gradient, and VTI (Figure 3–29).
- **High Q**: the number of heart cycles that the system uses to calculate the values selected in the **Doppler Results Display**.

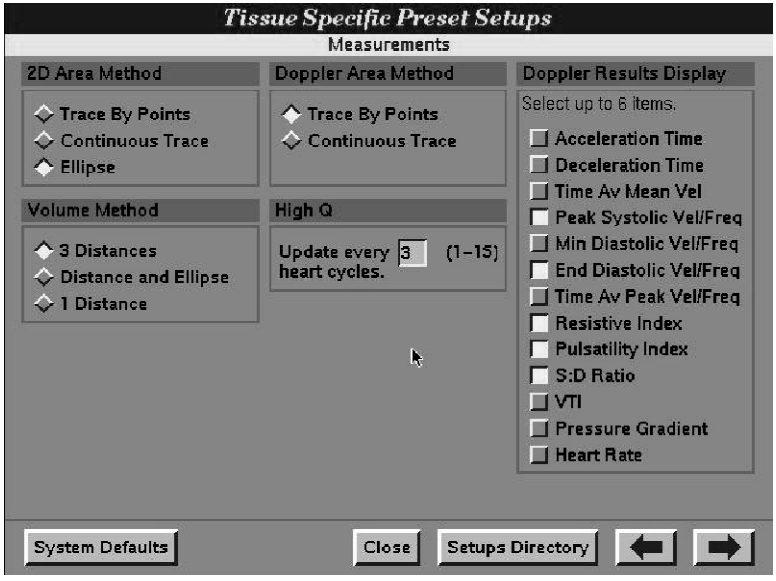


Figure 3–28. Measurements Setups: Non-Cardiology

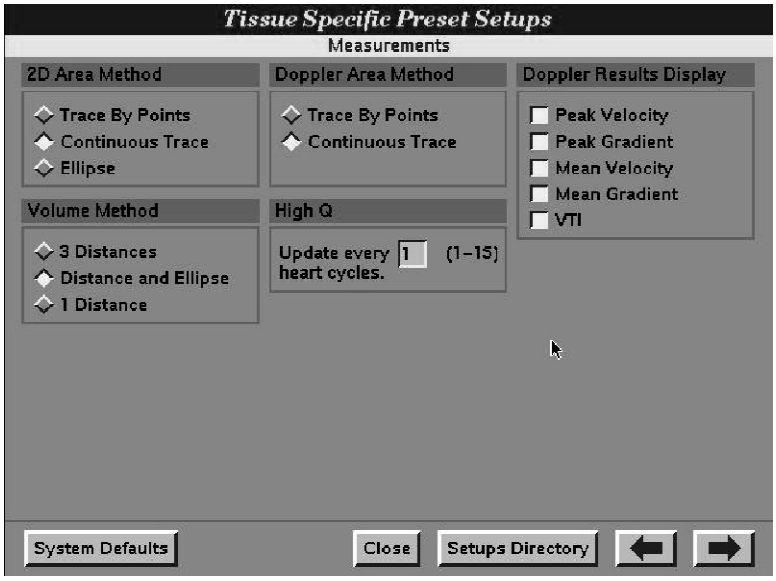


Figure 3–29. Measurements Setups: Cardiology

Tissue Specific Presets

When you create presets with the **Quick Save** key, the names that you assign to them appear in the list shown in Figure 3–30. You can delete user-defined presets using the **Delete** selection on the display.

From this same display, you can transfer user-defined presets between systems with the same level of system software. The DiskLink option is required for this feature, and an optical disk is used for this process. The **Copy** and **Install** selections are used to transfer user-defined presets.

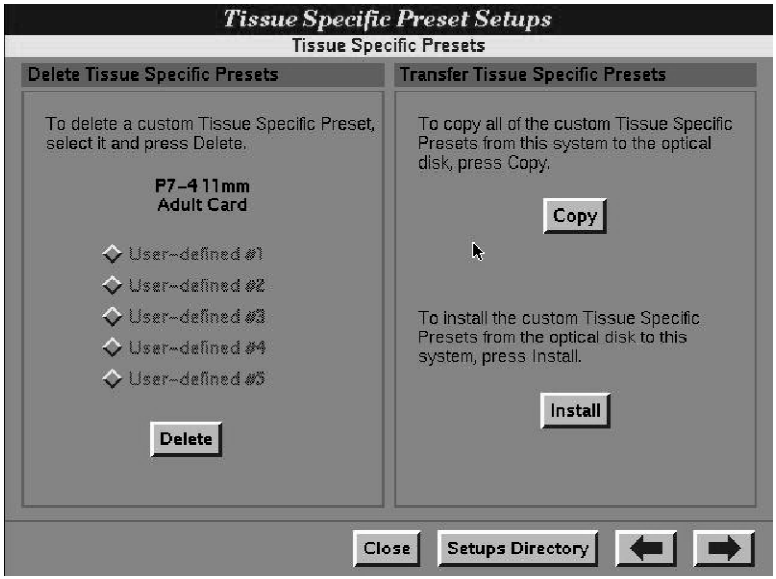

Tissue Specific Preset Setups
Tissue Specific Presets
Delete Tissue Specific Presets
To delete a custom Tissue Specific Preset, select it and press Delete.
P7–4 11mm
Adult Card
User-defined #1
User-defined #2
User-defined #3
User-defined #4
User-defined #5
Delete
Transfer Tissue Specific Presets
To copy all of the custom Tissue Specific Presets from this system to the optical disk, press Copy.
Copy
To install the custom Tissue Specific Presets from the optical disk to this system, press Install.
Install
Close
Setups Directory

Figure 3–30. Tissue Specific Presets

CAUTION

Transferring presets from a system with one version of system software to another system with a different version of system software can corrupt the presets database. This can result in poor system performance. Before transferring presets between systems, ensure that the software versions are the same. Your Customer Service representative can supply you with this information.

Diagnostics Setups

Selecting **Diagnostics** from the **Directory of Setup Options** displays the tests and utilities available with the system (Figure 3–31). You use the trackball and the **SELECT** control to select the diagnostic tests or utilities. The other selections on the **Diagnostics** display perform the following functions:

- **Start**: starts the test or utility.
- **Clear**: erases text entered into the **Results** area.
- **Save**: saves the text entered into the **Results** area to a file.
- **Search String**: refers to the text that you enter into the text area that is between **Search String** and the **Find** control. Use the keyboard to enter text into this area, and then select **Find**. The text that you entered, if it exists, will be displayed in the results area.
- **Find**: finds the search string that you entered into the **Search String** field.
- **Next Error**: displays the errors that were discovered by the test or utility.
- **Eject**: ejects the optical disk
- **Initialize Modem**: initializes a modem for the use of the remote diagnostics feature. Consult your Customer Service representative for more information about this feature.
- **Scroll Bar**: can be used to view the available test and utility results.
- **Setups Directory**: displays the **Directory of Setup Options**.
- **Close**: exits **Setups** and returns to imaging.

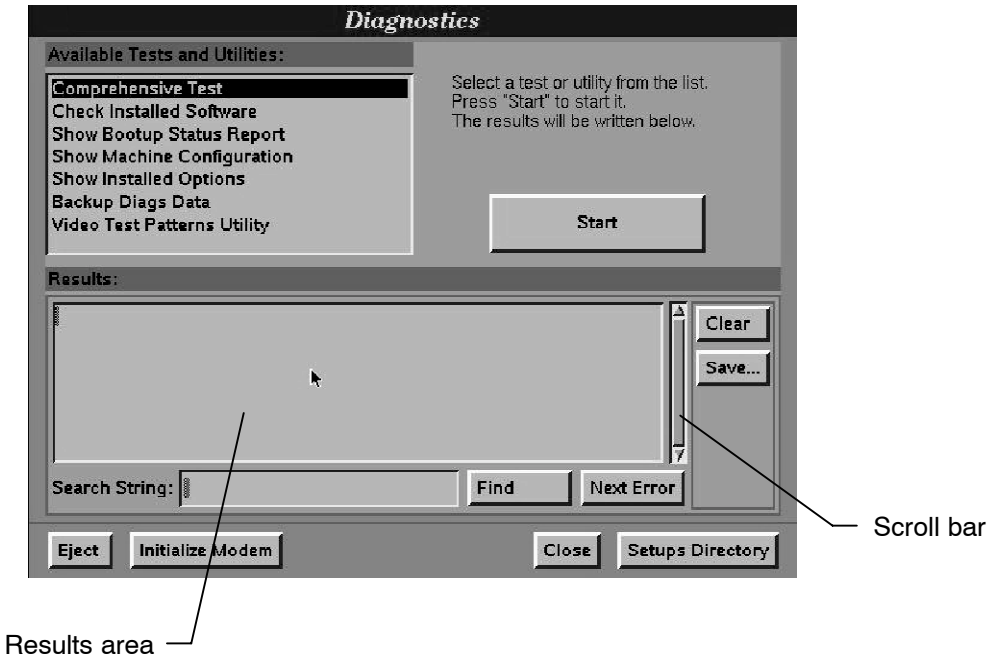


Figure 3–31. Diagnostics Setups

Software Setups

The software setups include a temporary option that allows an ATL representative to load a software feature onto the ultrasound system for temporary use (Figure 3–32).

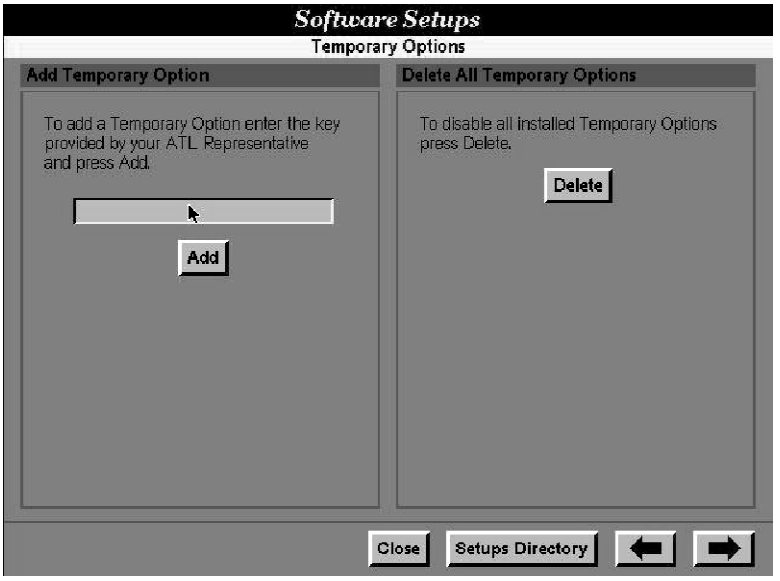

Software Setups
Temporary Options
Add Temporary Option
To add a Temporary Option enter the key provided by your ATL Representative and press Add.
Add
Delete All Temporary Options
To disable all installed Temporary Options press Delete.
Delete
Close
Setups Directory

Figure 3–32. Software Setups

Imaging

The system supports the following ultrasound imaging modes: 2D, M-mode, Doppler, Power, and Color imaging. Additionally, the system provides a physiological option that provides ECG, high-level ECG, auxiliary, pulse, and phono displays.

Image Displays

The image displays are shown in Figure 4–1.

The 2D image is a cross-sectional representation of anatomical structures. 2D images also display motion. The shape, position, texture, and dynamics of the anatomy displayed in the 2D image are presented in real-time. The use of high-resolution scanheads, high frame rates, different line density settings, various sector widths, and multiple image processing techniques helps optimize the 2D image.

The 2D image is also used to orient the scanhead for M-mode, Doppler, Color, and Power imaging. During M-mode zoom, the 2D image allows you to locate the area of interest for magnification. During Doppler imaging, the 2D image provides a reference for sample volume size, sample volume depth, and Doppler angle correction. In Color and Power imaging the 2D image provides the reference for the Color display. 2D Contrast Specific Imaging (CSI) is available for some scanheads. Pulse Inversion Harmonic 2D imaging is also available with a CSI clinical option.

Used with the 2D display, the scrolling Doppler display provides blood flow direction, speed, quality, and timing information. An understanding of hemodynamics and timing of normal and abnormal blood flow allows you to diagnose pathology using the Doppler display.

M-mode, or motion mode, is used with the 2D display. A line within the 2D image represents the M-line. Over time the movement of the anatomy along the M-line creates a scrolling display. M-mode is primarily a cardiology imaging mode.

Color flow imaging uses Doppler principles to generate a Color image. In Color flow imaging, Color is related to velocity and direction. This information is then used to overlay a Color image onto the 2D gray-scale display. The Color flow image provides information about blood flow direction, speed, quality, and timing. Color flow imaging helps you locate blood flow disturbances. Color flow imaging also helps you locate the sample volume for pulsed wave Doppler spectral analysis. Tissue Doppler Imaging (TDI) is a Color Doppler imaging technique used primarily in cardiology to display ventricular wall motion. TDI is available in 2D Color, M-mode Color, and PW Doppler imaging.

Color Power Angio (CPA) imaging and Power Motion Imaging (PMI) use Doppler principles to generate an image. In CPA imaging, color is related to the power or energy inherent in blood cell motion. This information is then used to overlay a Color image onto the gray-scale 2D display. CPA imaging is effective at lower ranges (PRFs) than either Doppler or Color, and therefore, is more sensitive to blood cell motion. CPA imaging can be used to provide a perfusion-like display of blood flow found in the vascular beds of certain tissue. Power Motion Imaging (PMI) is a cardiology power imaging feature for adult cardiology clinical options. PMI can be used to see cardiac wall motion and the walls of the great vessels. PMI Contrast Specific Imaging is available for some scanheads.

WARNING

Any suspected pathological condition detected by CPA imaging should be confirmed with Color imaging and Doppler imaging in accordance with standard diagnostic practices.

Duplex and simultaneous update are available for 2D, M-mode, and Doppler imaging. Triple mode is the simultaneous update and display of 2D, Color or Power imaging, and Doppler ultrasound information. Simultaneous CW Doppler imaging is also available. Triple mode can be used to decrease exam time and improve efficiency. Triple mode is available with a select set of scanheads.

Physio refers to physiological, and it can include electrocardiography (ECG), phonocardiography (phono), pulse, apexcardiography, high-level ECG, and other auxiliary physiological display information. Primarily a cardiology display, the timing information provided by these various displays is controlled from the **PHYSIO** and the **TRIGGERS** menus.

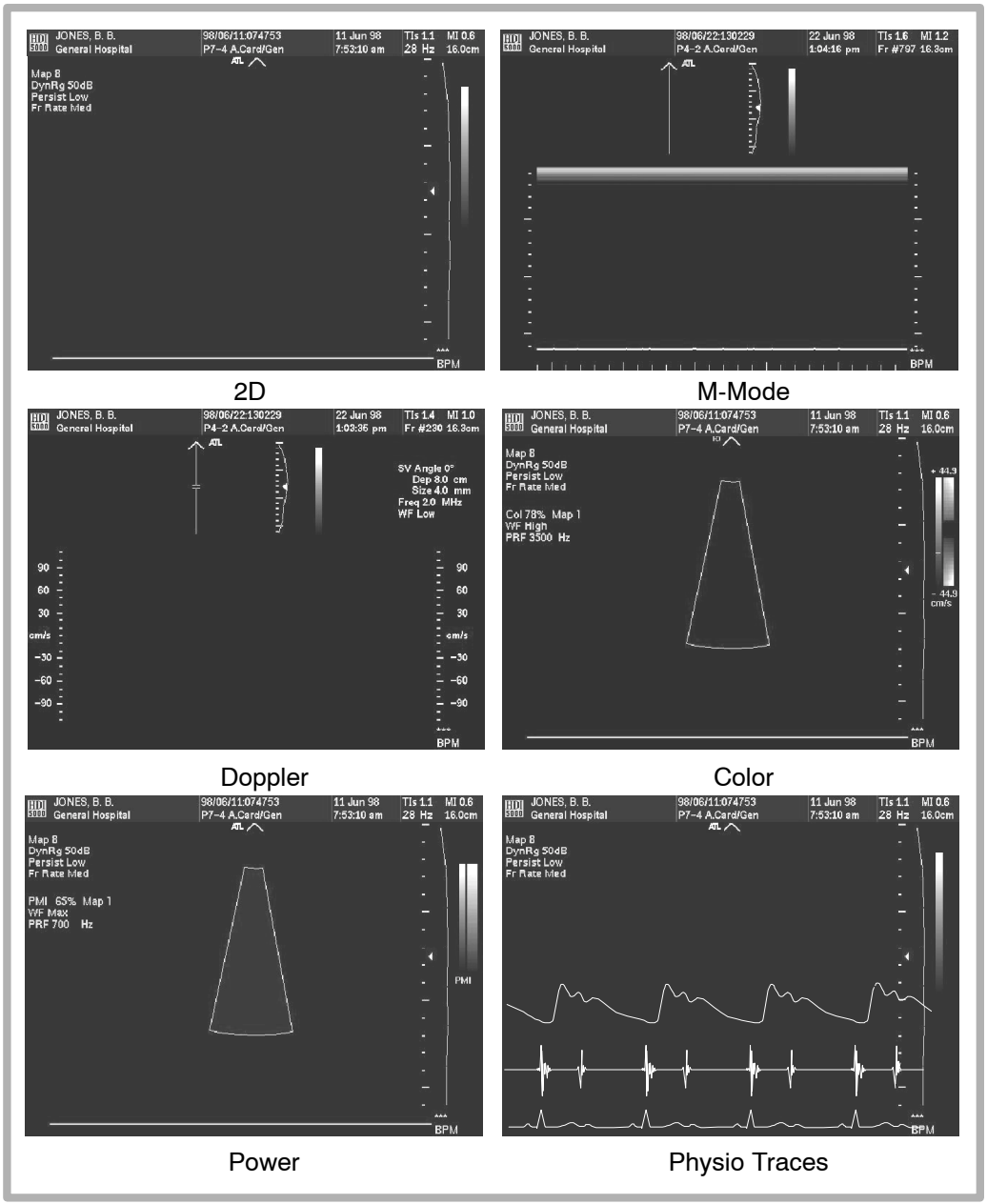


Figure 4–1. Imaging Displays

Patient Data

Patient data consists of the patient name and identification (Figure 4–2). This information is entered during patient data entry. When you press the **Patient Data** key on the keyboard, a form appears on the video monitor. You use the keyboard to enter patient data into this form. The name and ID appear at the top of all image displays. If you do not enter a patient ID, then the system automatically assigns an ID, which is based on the time and date of the entry.

The content of the **Patient Data Entry** form depends upon your system configuration. If you have purchased the Worklist option, not only will you have the worklist, but also the DICOM Modality Performed Procedure Step (MPPS) feature and the DICOM Storage Commit (SC) feature. All of these features affect the **Patient Data Entry** form. The Digital Video Streaming (DVS) option also affects the content of the **Patient Data Entry** form. The Worklist option is covered in the "Image Management" section. The DVS option is covered in the "Digital Video Streaming" section.

Institution

You enter the institution name into the **Display** setups, and it appears below the patient's name on the image display.

Time and Date

The time and date are located in the upper right corner. The date is used in some calculations protocols. For example: in Obstetrics, fetal age is calculated based on the date of the patient's last menstrual period. If the date displayed by the system is incorrect, then an erroneous fetal age will result from a calculation based on the incorrect system date. Ensure that your system displays the correct date and time. The time and date are set in the **Display** setups.

Image Information

The image information includes the thermal and mechanical indices, scanhead type, clinical option and Tissue Specific preset, depth, frame rate (or Cineloop frame number), and the date and time. Additional image information can be displayed by turning on **Image Info** in the **Display** setups.

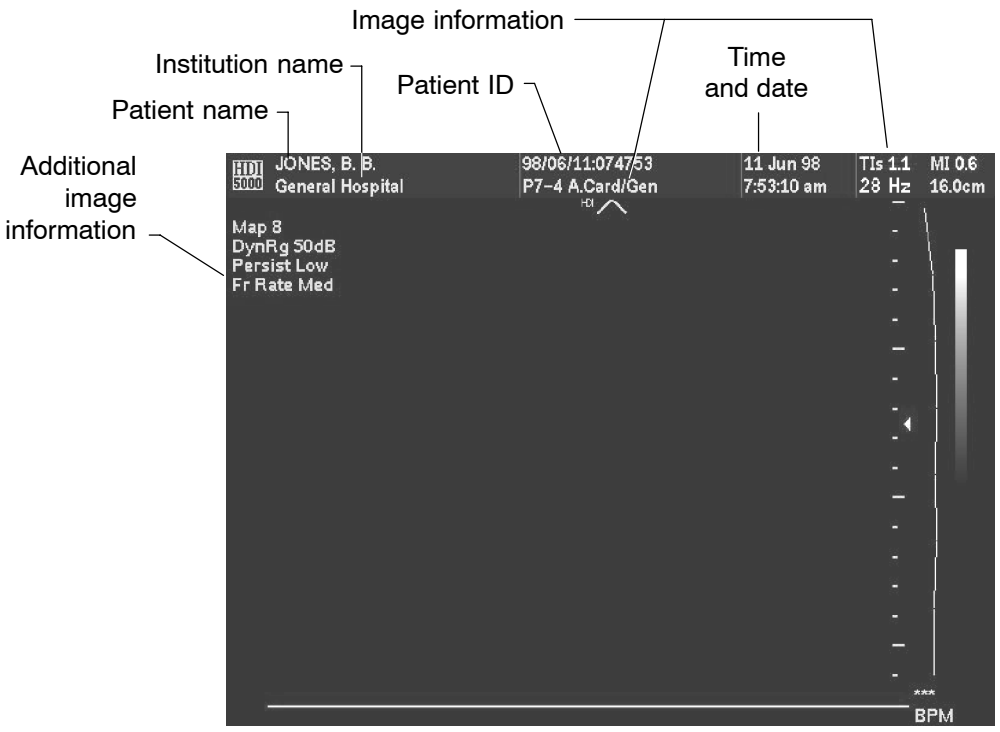


Figure 4–2. Image Information

Gray Scale and Color Scale

Gray Maps

The gray scale pattern, located to the right of the image display, depicts the gray-scale distribution; it corresponds to the **GMap** selection on the **2D/MMode** menu (Figure 4–3). When Chroma mapping is active, the chroma pattern is shown in place of the gray scale pattern. There are five gray maps available on the **2D/MMode** menu, or you can use the **Superkey** and, the **2D Maps** key. The five gray maps available are dependent upon the selected clinical option. The gray maps have been selected to optimize the display of 2D data for the clinical option.

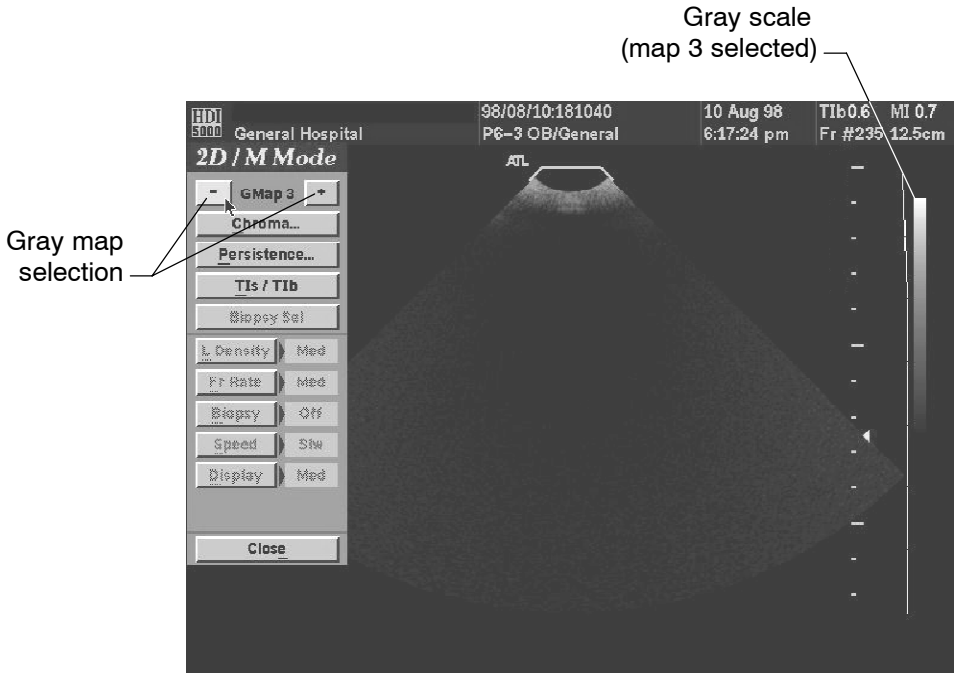


Figure 4–3. Gray Maps

Color Maps

The color scale, located along the right side of the image display, depicts the mapping of flow velocities to color (Figure 4–4). At each end of the color scale, there is a number with either velocity or frequency units. These numbers indicate the Nyquist limits. The **SCALE** control is used to change the Color PRF and the display range of the detected velocities or frequencies. On the **Color** menu, the **Units** selection alternates between the display of velocity and frequency units.

Additionally, you will note that the color scale is divided by a black area or baseline. The baseline represents the range of velocities filtered out by the wall filter and changes as you change the Color wall filter setting. Colors above the baseline generally represent flow toward the transducer, and colors below represent flow away from the transducer.

There are eight application-specific Color maps available through the **Color** menu on the **Color Maps** submenu. The Color map can also be changed using the **Superkey** and the **CMaps1** key.

In Color imaging, a color versus echo write priority threshold marker on the gray scale defines the 2D echo amplitude beyond which the system will write a shade of gray to the display. If the echo intensity at a certain point in the display does not exceed this threshold, then a color value will be assigned to this point. Raising this threshold displays color on brighter echoes. This threshold can be used to control unwanted color in the 2D image and help to confine color within vessel walls. The **PRIORITY** control is used to set this threshold.

On the **Color** menu, **Blending** allows you to vary the opacity of color over the grayscale image in Tissue Doppler Imaging. Using this selection you can view the grayscale image through the color overlay. Use the **Smooth** selection to improve color images. A low setting will improve spatial resolution while a high setting will improve the definition of the color written over the 2D image.

Selecting **Post Process** on the **Color** or **PWR** menus, displays the **Post Process** menu from which you can use **Color Capture** or **Color Tag**. **Color Capture** is used in both Color and Power imaging, during real-time, to calculate the highest mean velocity per pixel from a series of color frames and display a composite image that is the sum of the highest mean velocities. **Color Tag** is used in Color imaging to display a green tag on the color bar. You can adjust the position and size of the tag to identify velocities of interest in the color image.

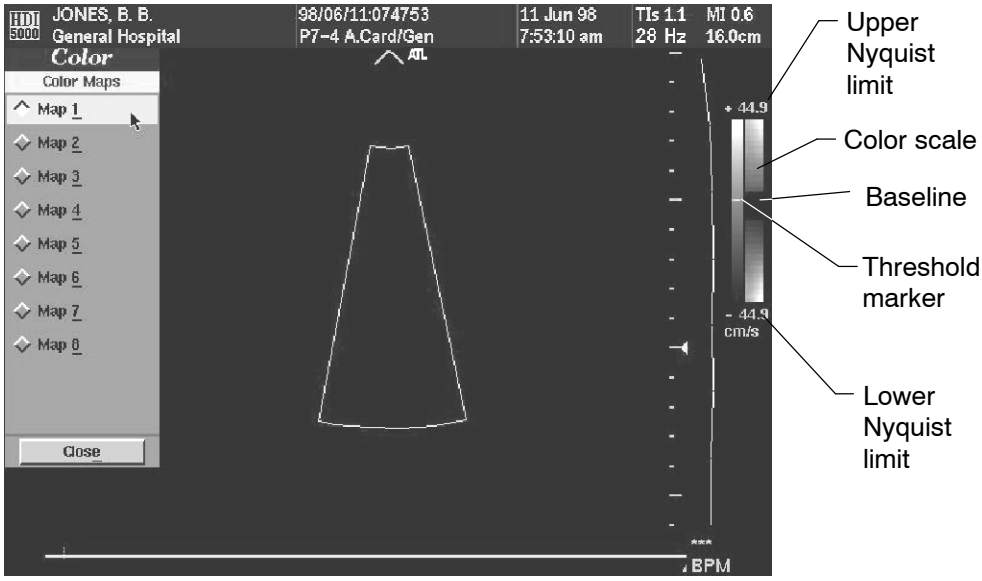


Figure 4–4. Color Maps

Power Maps

There are eight Power maps included in the system. The Power maps are located on a submenu, available from the **CPA** or **PMI** menus, which are displayed using the **PWR MENU** control (Figure 4–5). The Power map can also be changed using the **Superkey** and the **CMaps1** key.

The Power imaging color scale depicts the mapping of power or energy to color. The color can be changed by selecting a different map. You will notice that the color scale is continuous from top to bottom. Unlike the Color imaging color scale, which includes a baseline, Color wall filter, and directional annotation, the Power imaging color scale does not include these elements. These elements are not pertinent to Power imaging, which concentrates on the power or energy in blood flow without concern for direction.

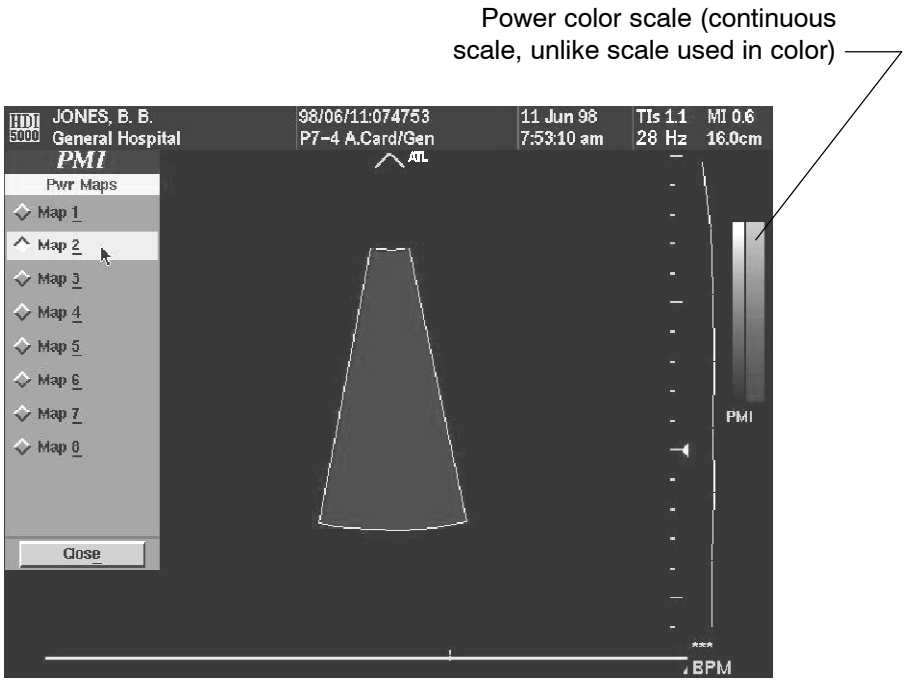


Figure 4–5. Power Maps

Doppler Gray Maps

The Doppler gray map can be changed from the Doppler **Gray Maps** submenu or by using the **Superkey** and the **Dop Maps** key. The Doppler gray maps that are included in the system are described below. Personal preference dictates which one you decide to use. Within each application, the Doppler gray maps have been selected to optimize the display of Doppler data for the application. The **Map** number is shown in the **Image Info**, which is turned on in the **Display** setups. There are five Doppler gray maps from which to choose (Figure 4–6).

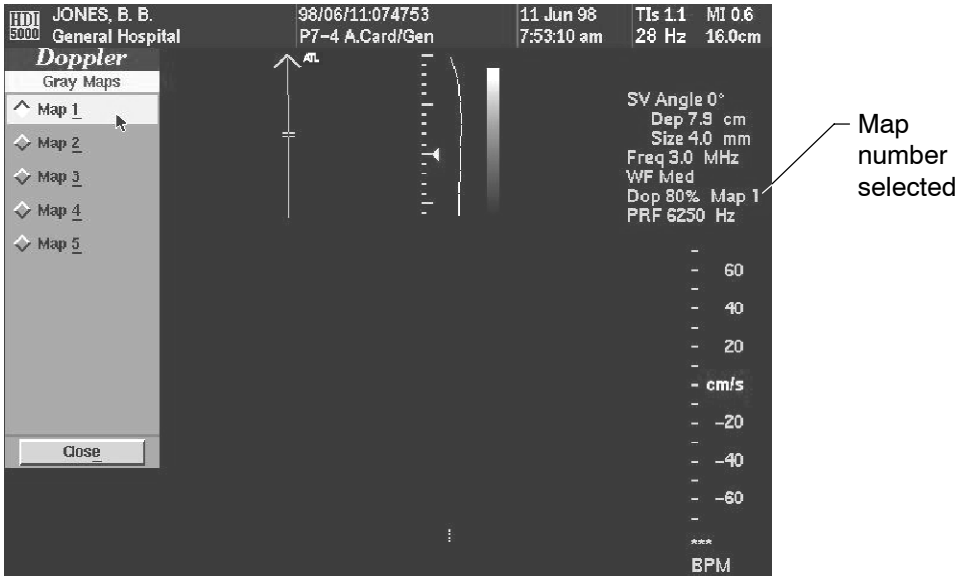


Figure 4–6. Doppler Gray Maps

Map 1 produces a crisp, contrasty spectral display. Map one should be used for spectral displays of low signal to noise ratio or to enhance weak signals by reducing background echoes. Possible applications are low or weak signal situations in cardiology or peripheral vascular studies.

Map 2 is a good all-purpose curve for peripheral vascular, abdominal Doppler, cardiac, and other variable flow presentations. This map will produce a black background with bright whites and some background echoes.

Map 3 increases background gray shades relative to **Map 2**. The spectral display appears softer with a longer scale contrast and wider latitude of gray shades. This map is useful in enhancing a variety of signal strengths in peripheral vascular or abdominal applications.

Map 4 decreases background gray shades relative to **Map 3** and **Map 5**.

Map 5 provides the widest gray-scale latitude and contrast. Use this map to optimize a wide variety of signal amplitudes within one spectral display. Map five is best suited for cardiology or disturbed flow conditions with a wide variety of velocities or frequencies.

Chroma Maps

Chroma mapping allows you to assign colors to gray-scale echo intensities. There are four Chroma maps available from the **Chroma** selection on the **2D/MMode** menu or the **Superkey** and **2D Chroma** key. There are four Chroma maps available from the **Doppler Chroma** submenu for the Doppler display (Figure 4–7).

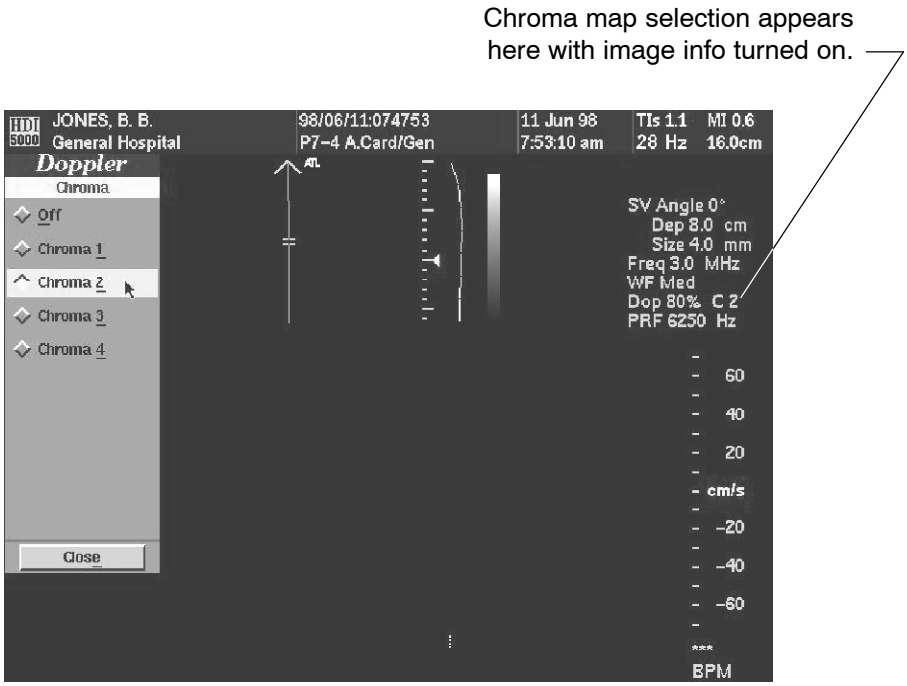


Figure 4–7. Chroma Maps: Doppler Example

Image Orientation

The orientation marker shows the orientation of the scan plane; it corresponds to the side of the scanhead with the scan plane indicator. If the display is inverted from top to bottom, using **TOP/BOT**, or flipped from left to right, using **L/R INVERT**, the orientation marker shifts with the image (Figure 4–8). The TGC curve and the depth scale will invert automatically.

Spectral invert refers to the orientation of the spectral display. You can display positive velocities or frequencies above the baseline with negative ones below the baseline, or you can display negative velocities or frequencies above the baseline with positive ones below the baseline. The velocity or frequency scale changes accordingly. The **INVERT** control changes the spectral display orientation; during Color or Power imaging, it inverts the Color or Power mapping distributions.

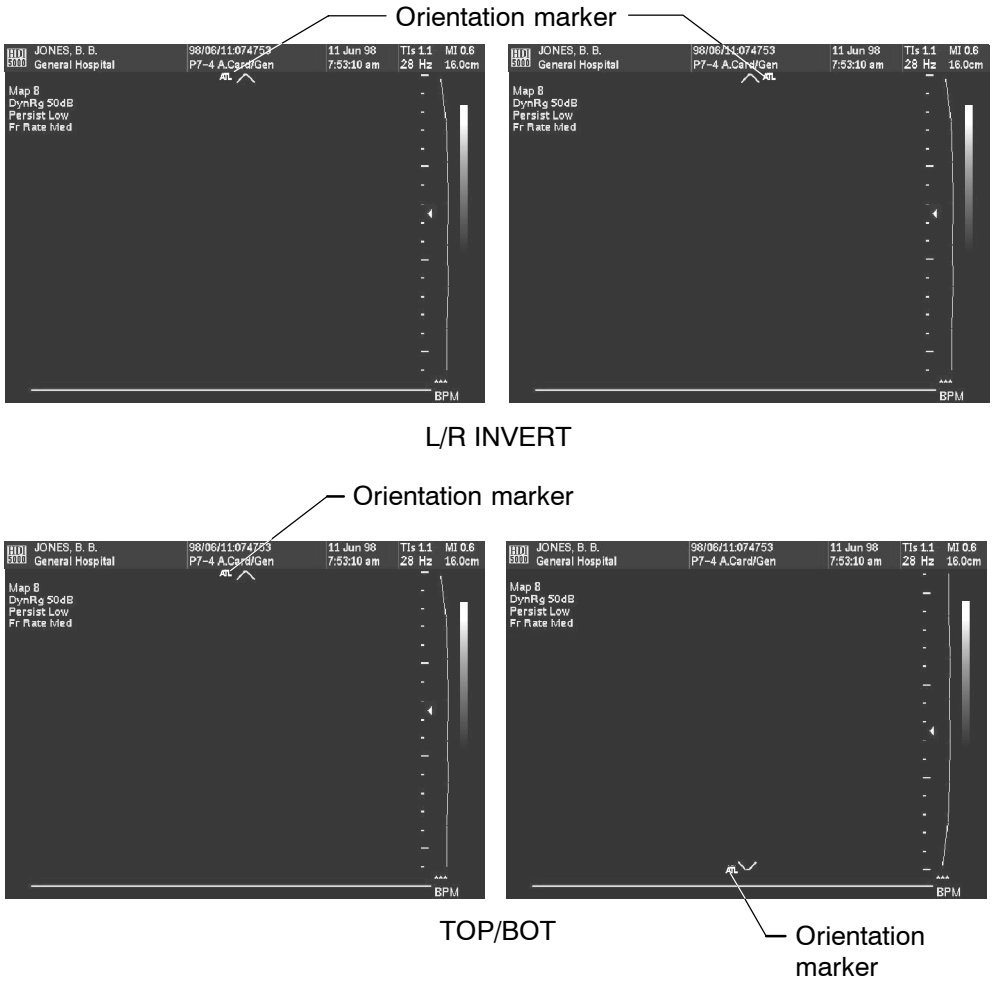


Figure 4–8. Image Orientation

Depth

The depth scale is marked off in centimeters and allows you to determine the depth of the echoes (Figure 4–9). Each small marker in the depth scale represents 0.5 cm in depth, a medium marker represents 1 cm in depth, and a large marker represents 5 cm in depth. The triangular marker to the right of the depth scale is the focal zone for the scanhead. Depending on your selection with the **ZONES** control, there could be as many as five focal zone markers on the depth scale. The **FOCUS** control is used to position the focal zone markers along the depth scale.

When you toggle the **DEPTH** control, the 2D image display, the depth scale, TI and MI values, frame rate, and focal depth can change. When you change the depth, you may also need to change the focal zone to enhance the area of interest. Overall range of the depth control is 2 to 25 cm, but exact range is determined by the scanhead used.

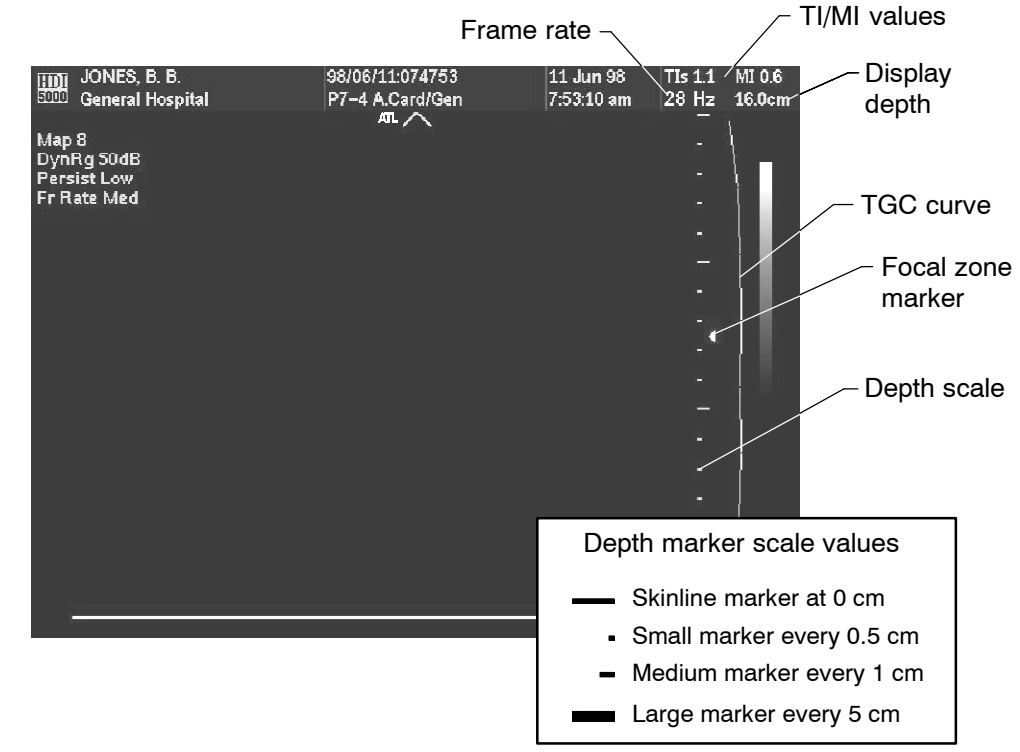


Figure 4–9. Depth

Output

When you adjust the **OUTPUT** control, you directly control the system acoustic power output. The output power is interpreted as a thermal index and mechanical index for display (Figure 4–9). On the **2D/MMode** menu, selecting **TIs/TIb** alternates between the display of TIs and TIb (**Superkey TI** also performs this function). TI Help displays a brief description of the output display standard implemented on the system.

GAIN and Time Gain Compensation (TGC)

The **2D GAIN** control governs the amount of amplification applied to the received echoes. This control determines the amount of amplification that all incoming echoes receive; it amplifies all echoes, weak and strong, regardless of depth. Additionally, gain can be selectively applied with the TGC slide controls. The TGC slide controls compensate for the attenuation of the echoes that occurs over time as they travel back to the scanhead.

The time gain compensation (TGC) curve, located to the right of the image display (Figure 4–9), corresponds to the time gain compensation applied by the system to the returning echoes. The TGC graphic on the screen does not correspond to the TGC slide control positions. The **Display** setup, **TGC Display**, turns the TGC display on or off. The **Display** setup, **TGC Values**, turns on the display of TGC values along the right side of the image. These values are used primarily for consistency in sequential Contrast Specific Imaging (CSI) studies. In PMI, TDI, and Power Harmonic imaging, the TGC slide controls affect only the PMI, TDI, or Power Harmonic image display. In 2D Color, Doppler, and CPA imaging the TGC slide controls do not affect the image; these imaging modes assume a flat TGC curve.

Because the Color and Power displays are displayed over the 2D image, the 2D GAIN control must be set properly. High 2D gain suppresses Color and Power information. Low 2D gain displays more Color and Power information. Adjust the 2D gain to the proper level for the gray-scale image, then use the **PRIORITY** control to adjust the amount of color displayed. Color gain should be set as high as possible without displaying random color speckle. If you set the **COL GAIN** control too low, then the lack of sensitivity makes it difficult to detect small abnormalities in flow and results in an underestimation of the large flow disturbances.

Color gain affects the mapping of variance. Since too high a **COL GAIN** setting causes random Color data, these pixels will be obvious when variance is added to the velocity display. In the variance mode, color pixels can be better confined to regurgitant jets if the Color gain is reduced slightly below the optimal velocity Color gain setting.

DOP GAIN controls amplification of the incoming Doppler signals. Doppler gain should be adjusted to a level that fills in the gray scale of the spectral analysis waveform without creating a mirroring effect above or below the zero baseline or introducing background noise.

Optimization

Optimization controls provide optimization for Tissue Specific imaging during 2D, Color, Tissue Doppler Imaging (TDI), 3D, and Harmonic imaging. Optimization is also available for Contrast Specific Imaging (CSI) during 2D, Color, and CPA imaging.

2D/COLOR

In 2D imaging, the General (**2D Opt:Gen**) setting is usually the default setting; it is the 2D image optimized for the Tissue Specific preset that you selected when you selected the scanhead, clinical option, and Tissue Specific preset. The other settings are for better resolution (**2D Opt:Res**), better or more penetration (**2D Opt:Pen**), and a fundamental setting (**2D Opt:Fund**) is for use in 2D CSI. **2D Opt:Res** takes advantage of the higher frequency portions of the scanhead bandwidth and results in an image with greater spatial resolution than the default setting. **2D Opt:Pen** takes advantage of the lower frequency portions of the scanhead bandwidth and results in greater penetration and sharper edge or border emphasis than the default setting. The 2D optimization is available in 2D, simultaneous M-mode imaging, and dual 2D imaging.

In Color and Power imaging, the optimization settings quickly optimize the system for specific flow patterns. **Flow Opt:High V** is useful for vessels exhibiting high velocity or high flow, and it provides additional tissue motion rejection. **Flow Opt:Med V** is the default and provides for medium flow. **Flow Opt:Low V** is useful for vessels exhibiting low velocity or low flow in small vessels. **Flow Opt:Med** provides a compromise between frame rate and resolution in cardiology presets. **Flow Opt:HFR** provides a faster frame rate than the **Med** setting, and **Flow Opt: HRes** provides better resolution than the **Flow Opt:HFR** setting. During Flow CSI, the optimization settings are **Pwr1**, **2**, and **3**.

In TDI, the optimization settings are **Tissue Opt:Gen**, **Res**, and **FR**. **Tissue Opt:Gen** is the default setting. **Tissue Opt:Res** takes advantage of the higher frequency portions of the scanhead bandwidth and results in an image with greater spatial resolution than the default setting. **Tissue Opt:FR** provides a faster frame rate than the default setting.

HARMONIC

Optimization for Harmonic imaging is available for 2D, CSI, and TDI. In 2D, simultaneous M-mode, simultaneous CW Doppler, PW Doppler, and dual 2D imaging, **2D Opt: HPen** provides better penetration than the default, **2D Opt:HGen** is the default, and **2D Opt:HRes** provides better resolution than the default. Several other settings are available depending upon the contrast agent and selected Tissue Specific preset: a **Fund** (Fundamental) default setting; **Hrm 1**, **2**, and **3**; and **CSI 1**, **2**, and **3**. The **2D/COLOR** control turns off Harmonic imaging.

In TDI, the Harmonic optimization settings are **Tissue Opt:Gen**, **Res**, and **HFR**. **Tissue Opt:Gen** is the default setting. **Tissue Opt:Res** takes advantage of the higher frequency portions of the scanhead bandwidth and results in an image with greater spatial resolution than the default setting. **Tissue Opt:HFR** provides a faster frame rate than the default setting.

FR (Frame) RATE

Optimization using the **FR RATE** control is available in several imaging modes. In SonoCT Real-time Compound imaging, the **FR RATE** control switches between **Survey** and **Target** imaging. In other imaging modes, the displayed frame rate value changes accordingly.

3D OPT

The **3D OPT** control is available to optimize the system for calibrated 3D imaging. When acquiring images for calibrated 3D imaging, pressing **3D OPT** optimizes the relationship between the system frame rate and the sweep speed to maintain image quality and enhance spatial resolution.

Focus and Zones

Each frequency and type of array scanhead has a set of transmit focal zones that are fixed at specific depths. The triangular marker to the right of the depth scale tells you where the focal zone or focal zones are located (Figure 4–10). Use **ZONES** to vary the number of focal zones and the distance or spread between the focal zones. The focal zones can be moved with the **FOCUS** control on the depth scale to pre-defined locations.

Alternating between 2D and Compound imaging may change the number and position of the focal zone indicators. **FOCUS** and **ZONES** operate the same as in 2D imaging, but the focal zone indicators are different in Compound imaging. See “SonoCT Real-time Compound Imaging” later in this section.

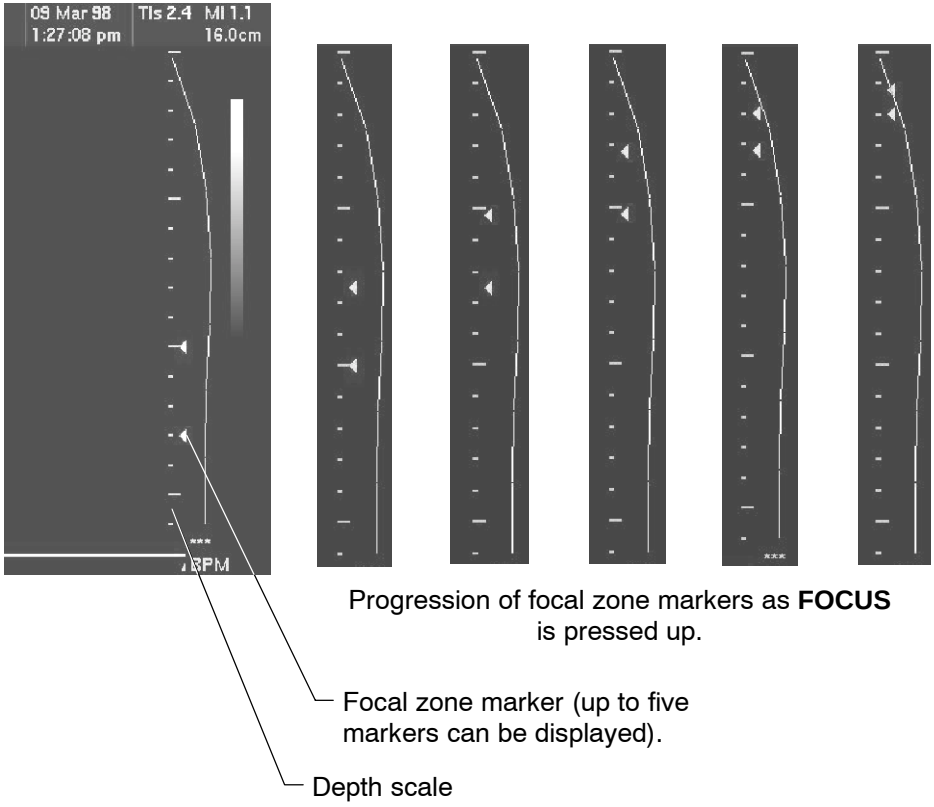

09 Mar 98
1:27:08 pm
TIs 2.4 MI 1.1
16.0cm
BPM
Progression of focal zone markers as **FOCUS** is pressed up.
Focal zone marker (up to five markers can be displayed).
Depth scale

Figure 4–10. Focus and Focal Zones

Zoom

The **ZOOM** control zooms or magnifies an area of interest of an image that is live or frozen (Figure 4–11). Zoom magnifies the area of interest up to eight times the normal size. The zoomed image can be panned or moved around with the trackball.

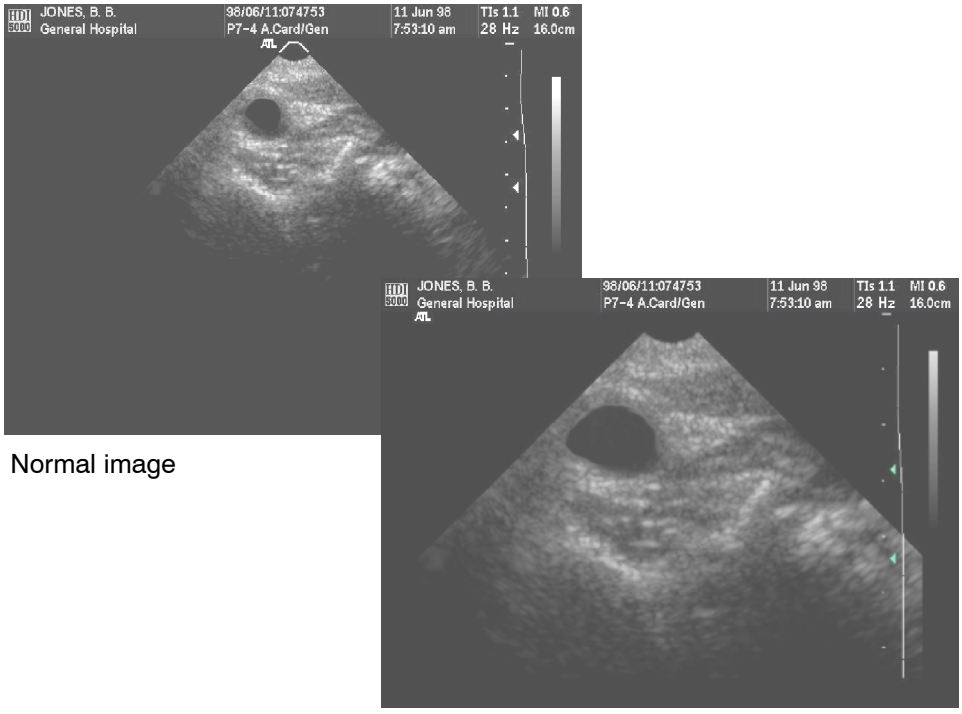


Figure 4–11. Zoom

High Definition (HD) Zoom

HD Zoom concentrates the system processing ability on a specific region of interest in the real-time image display (Figure 4–12). The **HD ZOOM** control is used to concentrate the processing power on this confined region. The result is less field of view overall, but greater detail and higher frame rate, which contributes to better image quality over the region of interest.

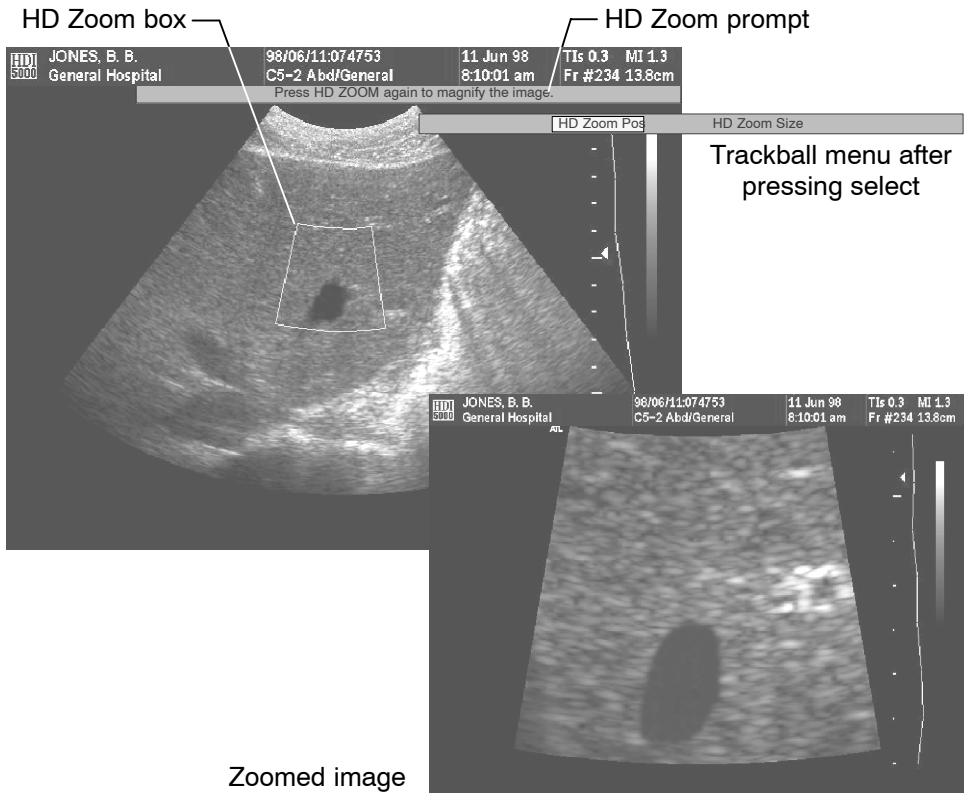


Figure 4–12. HD Zoom

In M-mode, HD Zoom provides better visualization of the M-mode data. Only the M-mode information defined by the M-line is displayed; unwanted M-mode information shallower or deeper than the anatomy of interest defined by the M-line in the HD zoom box is not displayed. M-mode zoom also allows you to see M-mode traces from small structures such as the fetal heart. M-mode zoom must be invoked from an active M-mode display using the **HD ZOOM** control; it cannot be invoked from a frozen display.

In Color and Power imaging, HD Zoom concentrates the system processing ability on the color overlay.

Dynamic Range

There are up to six dynamic range values available using the **COMPRESS** control. To change the dynamic range, ensure that the image is active. Usually individual preference will dictate which dynamic range you use. The screen annotation indicates 150dB/Cn, where 150dB is the total system dynamic range and n is a number from 1 to 6 corresponding to the compression curves available for selection (Figure 4–13).

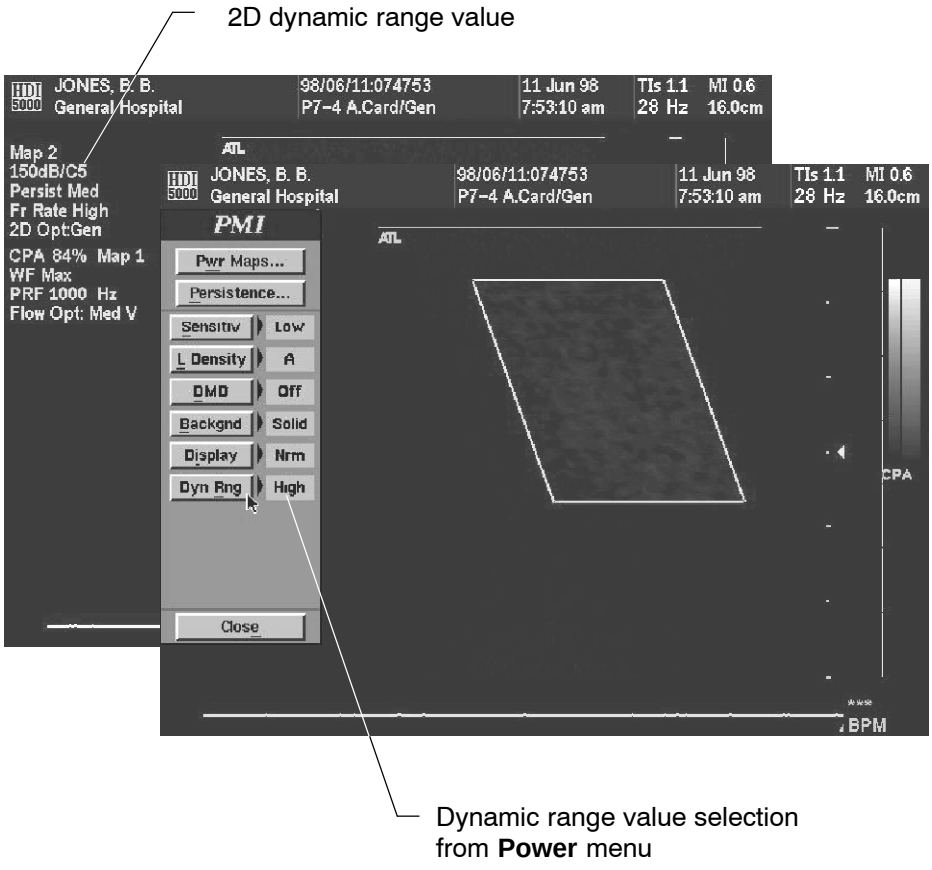


Figure 4–13. Dynamic Range

There are also four settings of dynamic range available from the **PWR MENU** control: **Low**, **Medium**, **High**, and **Maximum**. A lower dynamic range produces more contrast in the image and better sensitivity. A higher dynamic range setting eliminates noise from the display. Low dynamic range should be used for imaging deep small vessels, while higher dynamic range should be applied to large, high-velocity, shallow vessels.

Display

Display, available from the **PWR MENU** control, provides edge enhancement through special filter selections (Figure 4–14). There are three settings available: Normal (**Nrm**), Topography (**Topo**), and Resolution (**Res**). **Display** is not available in PMI.

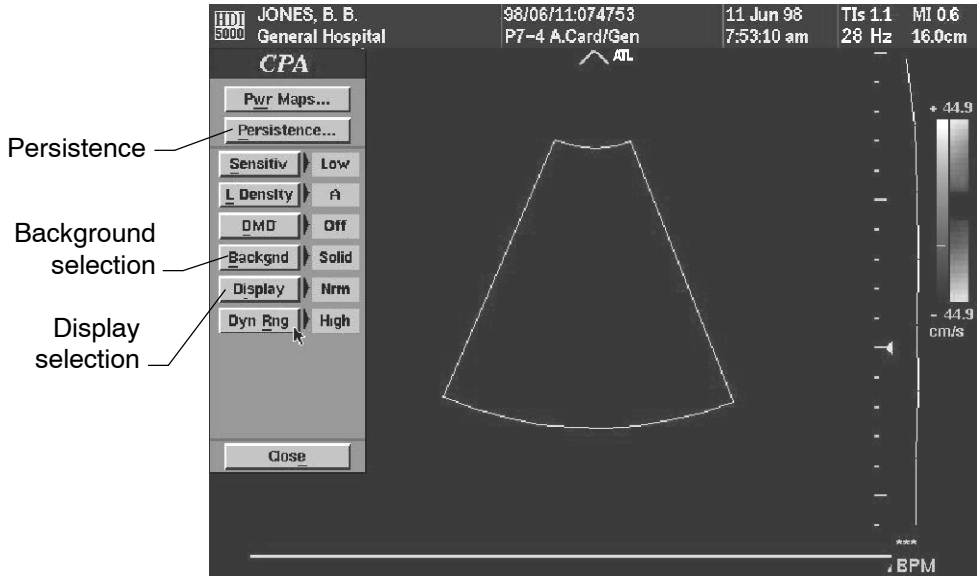


Figure 4–14. Display

The normal selection produces a **Power** display that can be used with the Background feature: blend, tint, and solid. The **Topography** selection produces a **Power** display with enhanced visualization of small vessels. The **Topography selection** is especially well-suited for visualizing small blood vessels in organs, such as the kidney. Topography works best on vessels that are oriented vertically on the **Power** display. When **Ttopography** is selected, the Power background is turned off. The **Rresolution** selection produces a Power display with enhanced resolution of small vessels, similar to topography. The **Resolution selection** is also well-suited for visualizing the kidney, and it works best on vertically oriented vessels on the **Power** display. When resolution is selected, the Power background is turned off.

Background

Background (**Backgnd)** allows you to turn off the color background in the **Power** overlay. When you do this, gray-scale information is visible in the **Power** overlay. For each pixel, either gray-scale or Power information is displayed. This either/or situation can create edge artifacts or flash artifacts. **Blend** smooths the transition between the Power and the gray-scale information. Decreases in edge and flash artifacts result. When **Blend** is selected as the background, the gray-scale and color hues are combined to produce pixels which contain a blend representing both kinds of information. The presence of Power data is dependent on the **PRIORITY** control setting. The result is a display in which the edges of blood vessels blend into surrounding gray-scale tissue. This blending increases the visual stability of the display in grayscale and color transition areas. There will be a smoother transition between gray-scale and Power information with blending than without it.

Blend can be used to enhance spatial resolution in small vasculature in certain applications. **Blend** improves image content and aids in anatomic orientation. It provides a balance between small vessel visualization and flash artifact suppression. **Background** is a menu selection on the **Power** menu (Figure 4–14), and there are three settings: **Solid**, **Tint**, and **Blend**. In PMI, only the **Solid** setting is available. The **Solid** setting displays a uniform background with no gray-scale information in the Power display. The **Tint** setting blends the uniform background with the gray-scale information coloring the gray-scale information.

Persistence

Persistence is a frame-averaging function. It allows you to eliminate image speckle present in the 2D display. The higher the persistence setting, the more frames averaged to generate the displayed image. The persistence settings are on a submenu of the **2D/MMode** menu (Figure 4–15); or you can use the **Superkey** and the **2D Pers** key. To change persistence, ensure the image is active.

Persistence averages Color frames, causing high-velocity flows to persist on the 2D image. Persistence allows better detection of short-duration jets, provides a basis for better flow/no flow decisions and produces better vessel contour depiction. Persistence is located on the **Color** menu, from which a submenu displays the Persistence settings; or you can use the **Superkey** and the **CPers** key. Persistence is not adjustable in Color M-mode imaging.

Persistence averages Power frames, causing high power to persist on the 2D image. Persistence allows better detection of short-duration jets, provides a basis for better flow/no flow decisions and produces better vessel contour depiction. **Persistence** is located on a submenu, available from the **Power** menu, which is displayed using the **PWR MENU** control. You can also use the **Superkey** and the **CPers** key.

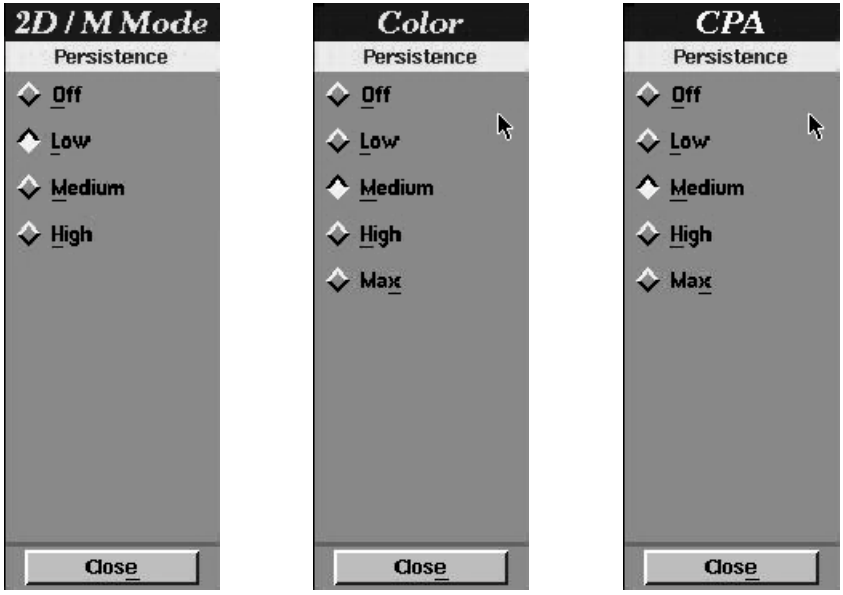


Figure 4–15. Persistence: 2D, Color, and Power

Line Density

Line density refers to the number of ultrasound lines that make up the ultrasound image. **L Density,** on the **Color** and the **Power** menus, adjusts the 2D/Color line density ratio. The four settings are scanhead dependent. The four settings are **A,** which is a low 2D line density and a low Color line density; **B,** which is a high 2D line density and a low Color line density; **C,** which is a low 2D line density and a high Color line density; and **D,** which is a high 2D line density and a high Color line density. Select the 2D/Color line density ratio that suits your application. Consider the Color overlay size, 2D sector size, and frame rate when you select the line density setting.

2D Sector Width

For scanheads that generate a sector 2D image, use the **SEC WIDTH** control to select a portion of the 2D frame and adjust the sector position using the trackball (Figure 4–16). (The rectangular image generated by the linear array scanhead is not adjustable.)

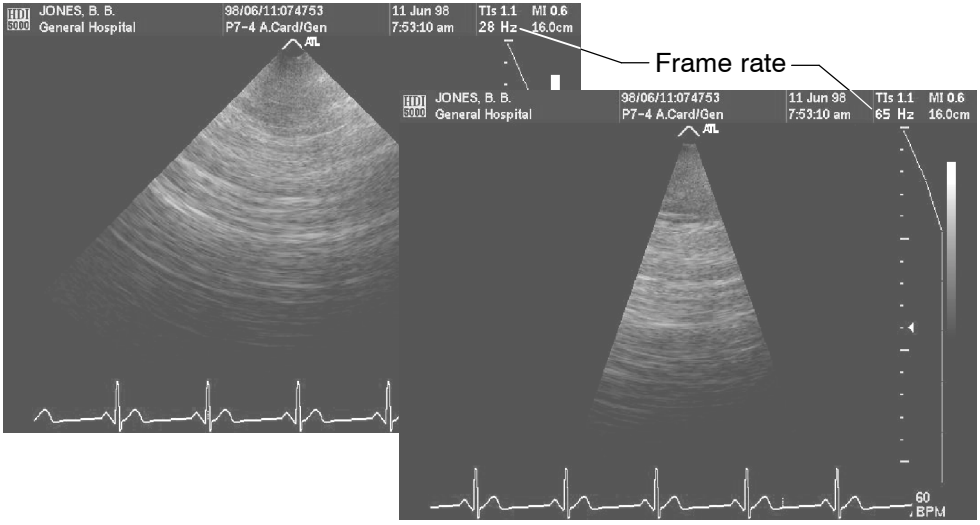


Figure 4–16. 2D Sector Width

Cursor

Pressing the **CURSOR** control displays a line of dots on the 2D image. The dots represent the M-line or D-line (Figure 4–17). For M-mode imaging, the cursor allows you to position the M-line on a full-size, 2D display and to locate the M-line before starting M-mode acquisition. For Doppler imaging, the cursor allows you to position the D-line and depth cursor on a full-size, 2D display before starting Doppler acquisition. The depth cursor corresponds to the sample volume depth.

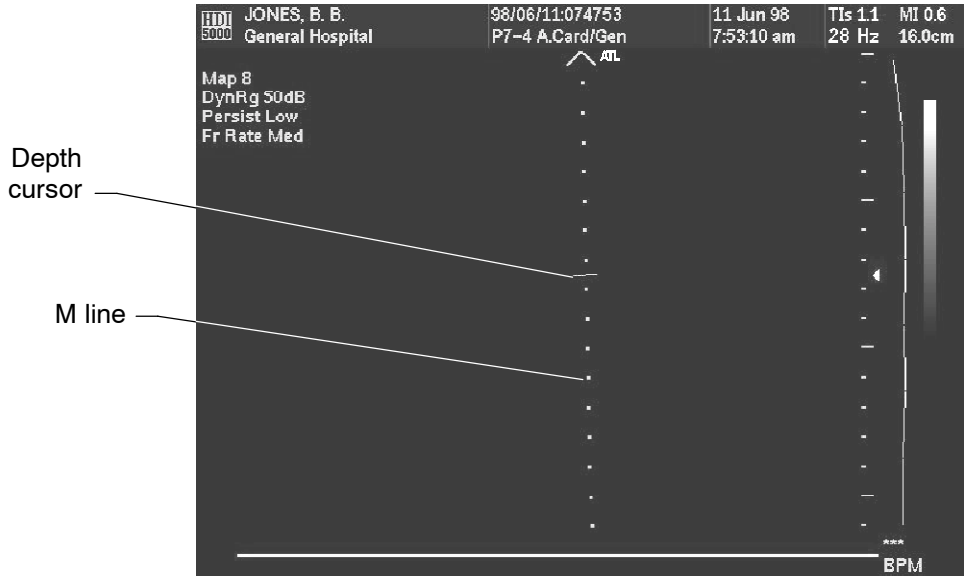


Figure 4–17. Cursor

Display Format

Display format refers to the size of the scrolling display: small, medium, and large (Figure 4–18). The size of the 2D image also changes. As the scrolling display increases in size, the 2D image decreases in size. Changing the display format allows you to customize your display. Your immediate interest may be with the M-mode display or you may want to take a print of the Doppler display with the smaller 2D display for reference. Measurements may also be easier on a larger scrolling display format. Three display formats provide you a more flexible display space. **Display Format** on the **2D/MMode** and **Doppler** menus or the **Superkey** and the **Disp Format** key controls the scrolling display size.

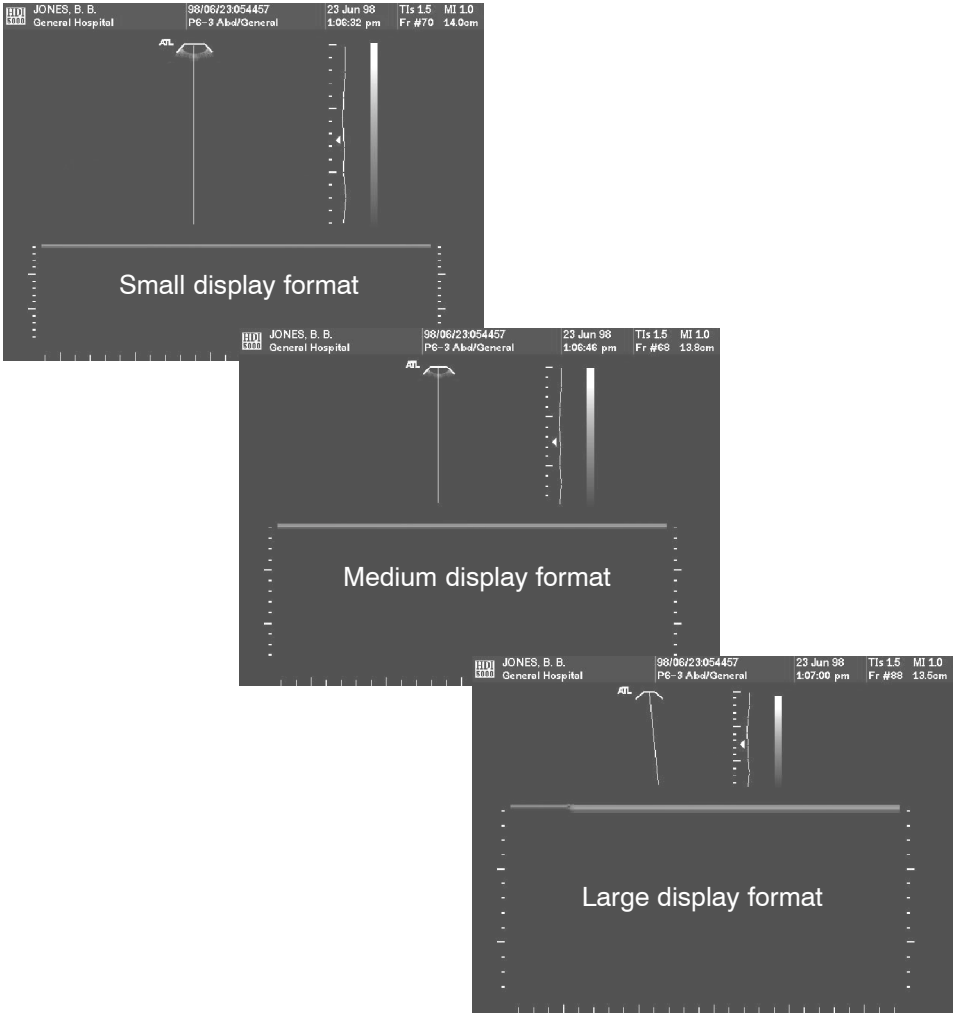


Figure 4–18. Display Format

Time Scale

The time scale is located beneath the M-mode display and scrolls along with the M-mode display. The time markers are calibrated to match the sweep speed. There are three sizes of time marker. The largest time marker denotes a time of 1 second, the smaller time marker denotes 0.2 second, and the smallest time marker denotes 0.1 second. The smallest time marker appears only at the faster sweep speeds (Figure 4–19).

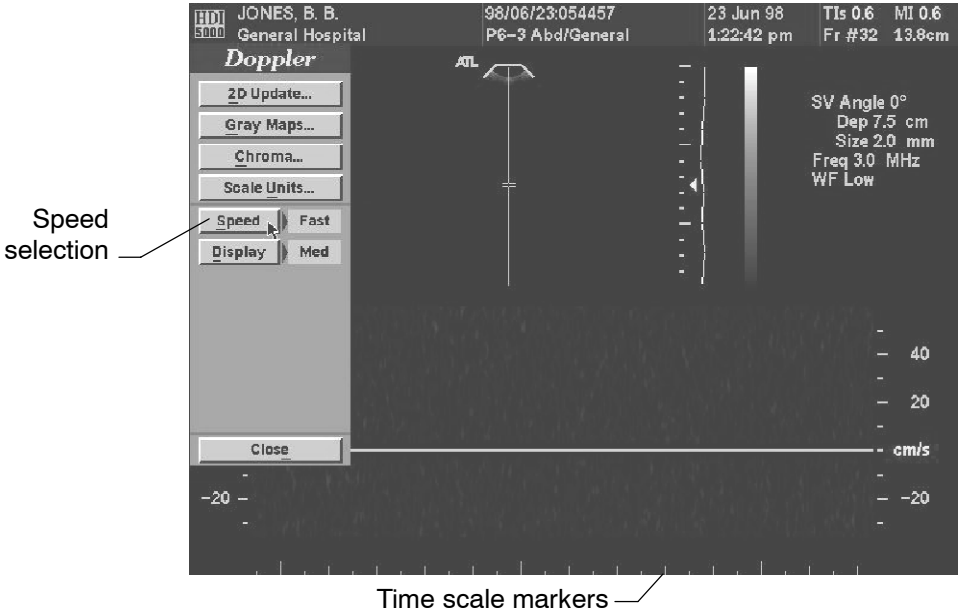


Figure 4–19. Time Scale

Speed, on the **2D/MMode** menu (or the **Superkey** and the **Speed** key), allows you to select one of the available sweep speeds: **Slow**, Medium (**Med)**, **Fast,** or Maximum (**Max)**. When the M-mode sweep speed is changed, the M-mode display and memory review buffer are cleared of data before a different sweep speed begins.

Speed on the **Doppler** menu (or **Superkey** and the **Speed key**) allows you to select one of the available sweep speeds: **Slow**, Medium (**Med)**, **Fast**, or Maximum (**Max**). Each successive press changes the sweep speed. A sweep speed of medium is suitable for normal use, but a fast sweep speed may be useful to show the shape of some flow curves. If, for example, a flow curve is to be analyzed carefully to calculate a mean pressure gradient, then it will be much easier to do this on a faster speed Doppler trace than on a slower speed one. There are three sizes of time marker. The largest time marker denotes a time of 1 second, the smaller time marker denotes 0.2 second, and the smallest time marker denotes 0.1 second. The smallest time marker appears in fast and maximum sweep speeds.

When the Doppler sweep speed is changed, the Doppler display and memory review buffer are cleared of data before a different sweep speed begins.

Sample Volume Size and Position

In pulsed Doppler, a specific area or volume along the ultrasound beam is sampled. This area is called the sample volume. The sample volume is located on the ultrasound beam at the sample volume depth, the value of which is displayed in centimeters along the right side of the display in the annotation area (Figure 4–20). You can change the location and size of the sample volume. The trackball changes the location of the sample volume; the **SV SIZE** control changes the size of the sample volume.

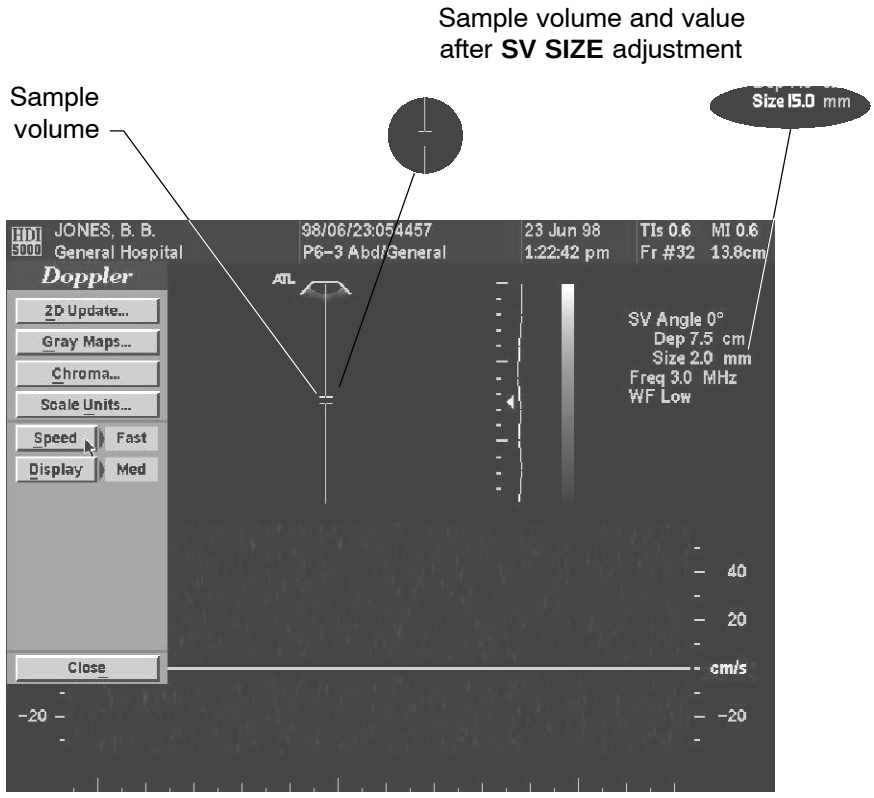


Figure 4–20. Sample Volume Size and Position

Overlay Size and Position for Color and Power Imaging

The ability to change your Color overlay size and position provides flexibility in Color imaging (Figure 4–21). Pressing the **SELECT** control displays a trackball selection menu that shows the current trackball assignment and allows you to change that assignment. The trackball changes the Color size and position of the overlay. In HD Zoom, the overlay defines the region of interest.

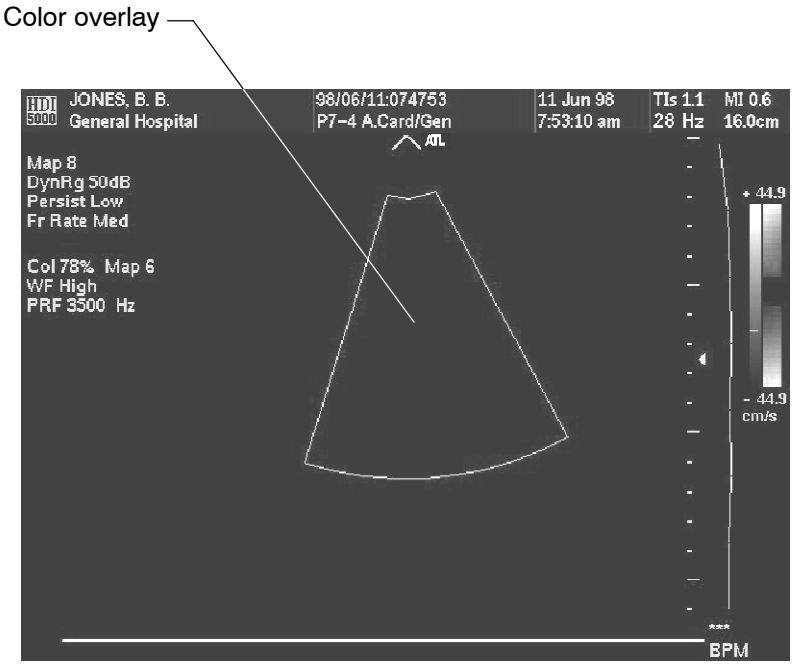


Figure 4–21. Overlay Size and Position

Frequency/Velocity Scale

The frequency or velocity scale is located along the right border of the spectral display. Depending upon your selection, the scale is calibrated in frequency units (kHz), 5 MHz equivalent frequency, or velocity units (cm/s). The 5 MHz equivalent frequency selection calibrates the Doppler scale based on a 5 MHz frequency. The 5 MHz equivalent frequency is a parameter used in some scientific literature to classify certain carotid disease conditions.

The **SCALE** control sets the PRF, which sets the ranges of the Doppler, Color, and Power scales. In Doppler, angle correction affects the velocity scale, which is automatically adjusted to account for a change in the Doppler angle. The **SCALE** control also enables high PRF Doppler imaging, see “High PRF Doppler Imaging” later in this section.

The Doppler scale is divided by a zero baseline that extends across the width of the spectral display. The baseline serves to divide the velocity or frequency scale into positive and negative values. The **BASELINE** control adjusts the baseline position. The data above the baseline is normally classified as forward flow, spectral data below the baseline is normally classified as reverse flow (this relationship can be reversed with the **INVERT** control).

In Color, changing the Color baseline allows you to emphasize flow in one direction at a time, either forward or reverse. As with the Doppler baseline, the Color baseline can be used to prevent aliasing in one direction. The Color baseline is depicted on the Color bar in black. The Color wall filter centered on the Color baseline is similarly depicted on the Color bar with black. As the Color wall filter is changed, the black area to either side of the Color baseline changes to reflect the range of the Color wall filter.

Sensitivity refers to the number of ultrasound bursts used to form a line of Color or Power data. More bursts result in more sensitivity but reduces the frame rate. In addition, more bursts increases sensitivity to low velocity flow resulting in better Color filling of vessels. Color sensitivities of low, medium, high, and maximum are available on the **Color** and **Power** menus. Sensitivity cannot be adjusted in Color M-mode imaging.

The **PRIORITY** control establishes the amount of Color and Power displayed over bright echoes and helps confine Color within the vessel walls. Raising this threshold displays Color on brighter structures. If you see Color on vessel walls, then the priority threshold is probably too high. Additionally, wall motion ghosting can be suppressed with a low priority setting. The maximum priority setting is automatically invoked when Power imaging begins.

Angle Correction

Angle correction adjusts the Doppler scale to account for the cosine theta (Doppler angle). The range of this control is –70° to +70° in 2° increments. Press the **0/60°** control to make a coarse adjustment before making finer adjustments. Push the **ANG COR** control up to rotate the flow direction cursor in the counterclockwise direction, push it down to rotate it in the clockwise direction (Figure 4–22). Holding the **ANG COR** control will result in what is termed “auto repeat” which causes a faster display response. An acceptable angle between flow direction and examination beam can usually be found by selecting different imaging windows. One of the applications of Color imaging can be to determine more accurately the flow direction.

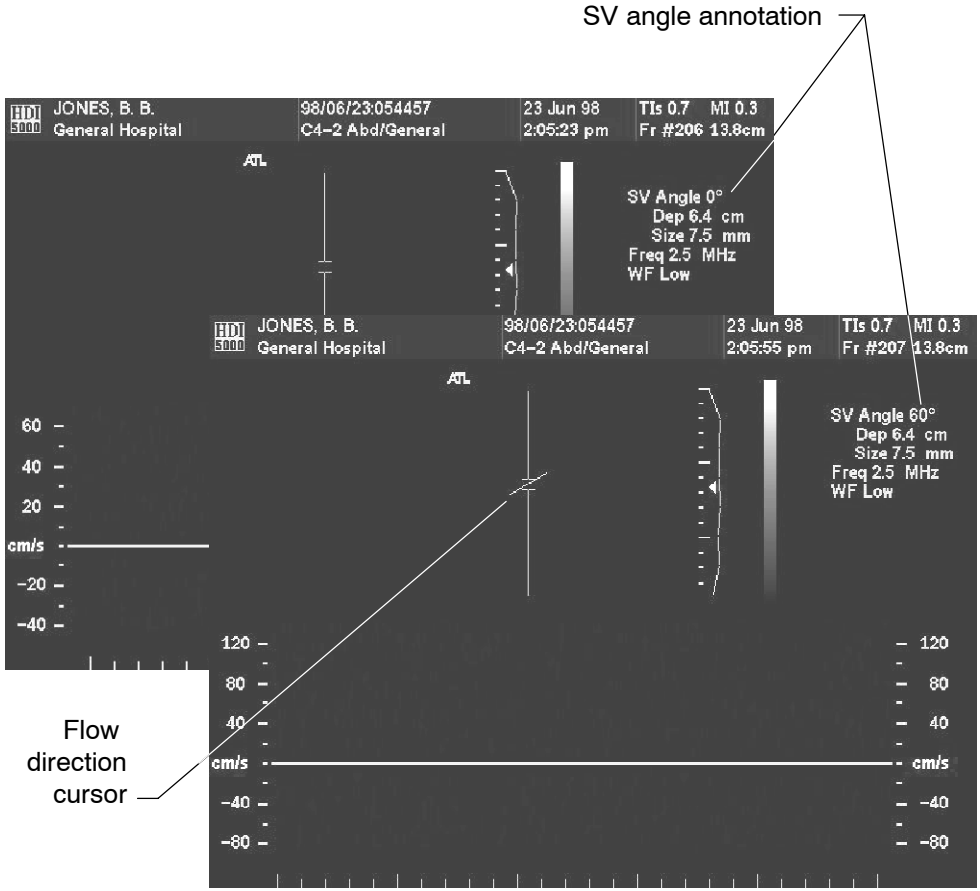


Figure 4–22. Angle Correction

Filters

Wall filters are used in Doppler, Color, and Power imaging to eliminate vessel wall or cardiac wall motion noise that is low in frequency but high in intensity. A wall filter high enough to remove the audible thumping of the cardiac walls but sensitive enough to retain gray-scale spectral information near the baseline is ideal. The **FILTER** control is used to change the wall filter. The settings are low, medium, and high. A maximum filter setting is available in Color and CPA imaging (Figure 4–23). The filters are not used in Tissue Doppler Imaging (TDI).

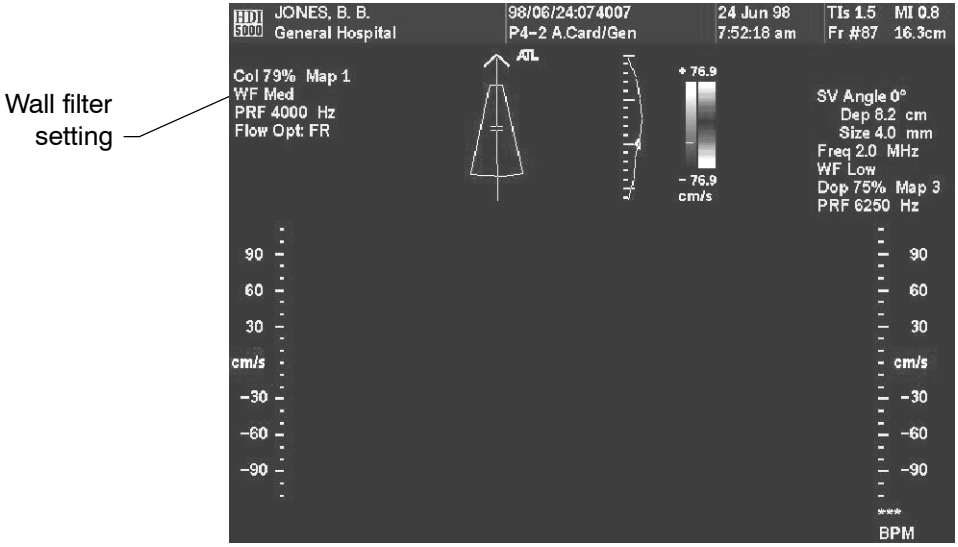


Figure 4–23. Wall Filters

The wall filters are user-selectable, but the actual cutoff frequencies vary depending on the PRF. The lowest wall filter cutoff frequencies cannot be used with the higher PRF settings. Likewise, the highest wall filter cutoff frequencies cannot be used with lower PRF settings.

A medium wall filter allows a good compromise in easy to moderate adult cardiac patients. It allows good color filling with good wall motion suppression. Lower wall filter settings provide better color filling in the left ventricle, and particularly in the atria and right heart, but at the expense of increased wall motion ghosting. Most abdominal applications require a wall filter that provides filling to vessel walls without displaying color on the vessel walls. A high color wall filter setting not only reduces wall motion ghosting, but also makes it easier to identify mitral and tricuspid regurgitation. A high color wall filter setting with a higher priority threshold (**PRIORITY** control) is useful in most exams exhibiting mitral and tricuspid regur-

gitation without normal diastolic flow. Increasing the priority threshold may be necessary to overcome high echo clutter levels in the heart chambers of difficult-to-image subjects.

In cardiology applications, the PMI wall filters have been modified to optimize visualization of the myocardium in difficult-to-image patients.

Dynamic Motion Differentiation

Dynamic Motion Differentiation (**DMD**) is a motion artifact suppression feature for Color and Power imaging. It is an adjunct to the wall filter. The wall filter is set to filter only velocity signals associated with tissue wall motion at a specific frequency range. The DMD filter, as the name indicates, dynamically adapts to filter signals from tissue. DMD measures the incoming signal before performing any filtering. It then adaptively filters the signal at the frequency that best rejects tissue wall motion allowing the display of flow. **DMD** is located on the **Color** and **Power** menus and can be turned on or off (Figure 4–24). DMD cannot be selected in Color M-mode or PMI.

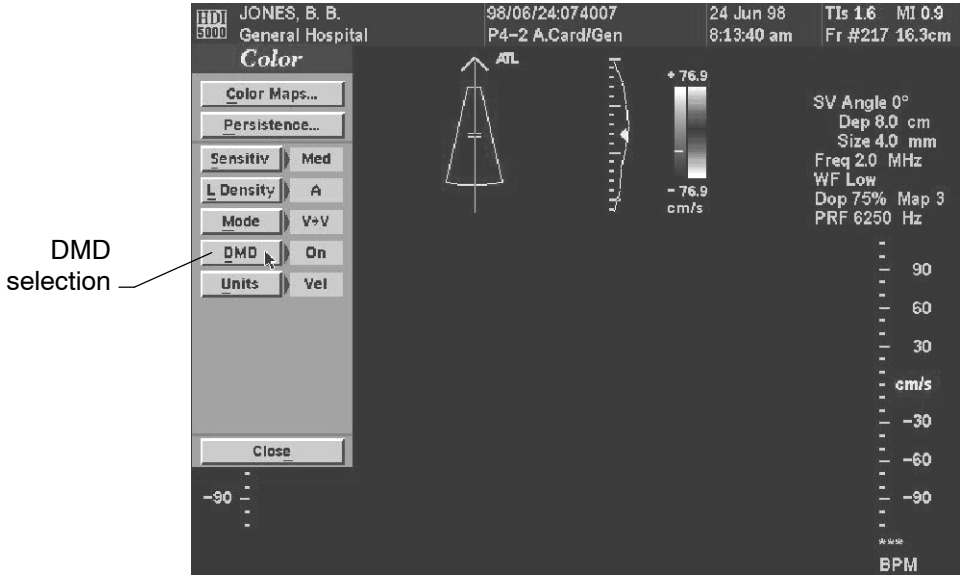


Figure 4–24. Dynamic Motion Differentiation

Continuous-Wave (CW) Doppler

CW Doppler uses continuously transmitted and received ultrasound energy to generate a spectral display. Pulsed Doppler uses pulses of sound waves to evaluate flow characteristics of direction and speed in a specific location. However, in pulsed Doppler, the time for echo information to return to the transducer may be too great to accurately measure certain high velocity flows, resulting in false directional information known as aliasing.

CW Doppler allows accurate high velocity determination. The sample rates for CW Doppler are greater than those available in pulsed Doppler. CW Doppler should be used for measuring high velocity flow rates when the location of the flow is unimportant.

Some phased array scanheads and pencil probes provide CW capability. Pressing the **CW** control turns CW Doppler on or off. If a scanhead does not support CW operation, a message to that effect will appear on the display.

Simultaneous CW Doppler imaging is available with some scanheads. Selecting **Simul** from the Doppler **2D Update** menu activates simultaneous CW Doppler imaging.

Steering Angle (Linear Array)

Doppler, Color, and Power imaging with a linear array scanhead is somewhat different than with other scanheads. Steering of the ultrasound beam may be necessary to get a meaningful display with a linear array scanhead. To accommodate this situation, the D-line is steered. The **STEER** control allows you to cycle the angle among three possible settings (Figure 4–25).

The steering of the ultrasound beam for the linear array is independent of the angle correction controls. The angle correction controls are used to calibrate the velocity scale for the angle that exists between the ultrasound beam and blood flow. The steering angle control does not directly affect the calibration of the velocity scale.

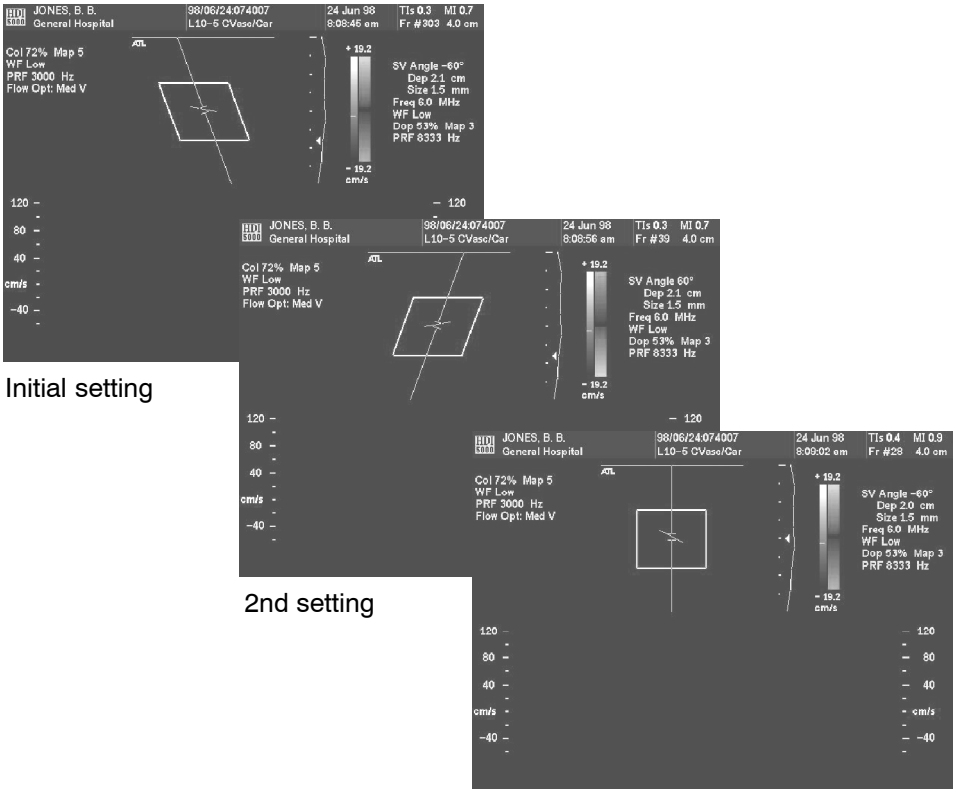


Figure 4–25. Steering Angle

2D Update

In Doppler, you determine the 2D update method using the **2D Live** selection on the Doppler **2D Update** submenu (Figure 4–26). You can display the **Doppler** menu, and then determine the update method: simultaneous or 2D Live (duplex). Press the **UPDATE** control to alternate between 2D update and Doppler update. The **UPDATE** control is also used in dual 2D, Color M-mode imaging, and ECG-triggered operation.

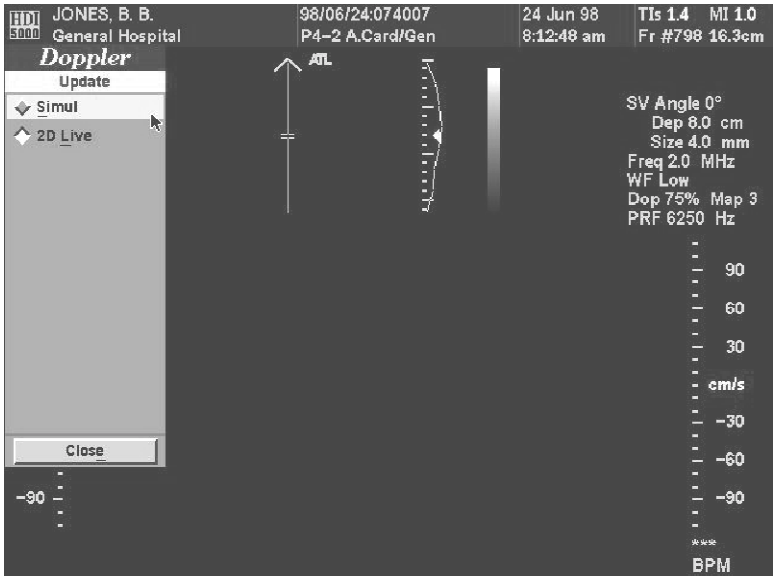


Figure 4–26. 2D Update

Mode

In Color imaging, you can choose among three different display modes (Figure 4–27): velocity (**V**), velocity and variance **(V+V)**, and power (**Pwr**). Velocity displays speed and direction of the blood flow. Variance displays variation from normal velocity or turbulent flow. Power displays amplitude information relative to blood flow, and it is useful in evaluation of low velocity flow. Consider the following when using Power mode: The C7–4 scanhead is the best scanhead for this type of imaging. Cardiac motion and aortic bounce adversely affect the image; ask patients to hold their breath for best results. Use complementary modes of operation for data verification.

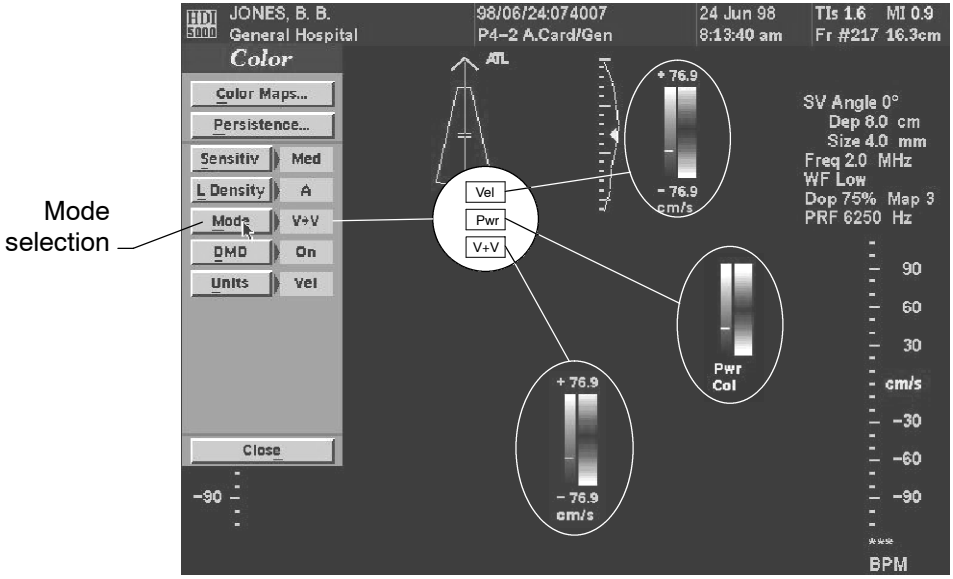


Figure 4–27. Mode

Cineloop Image Review

Cineloop image review is the storage and review of a sequence of images in system memory. Cineloop review is available by pressing the **FREEZE** control. Moving the trackball to the left or right moves through the Cineloop sequence. Images from a Cineloop sequence can be measured and annotated. Cineloop sequences help identify timing information.

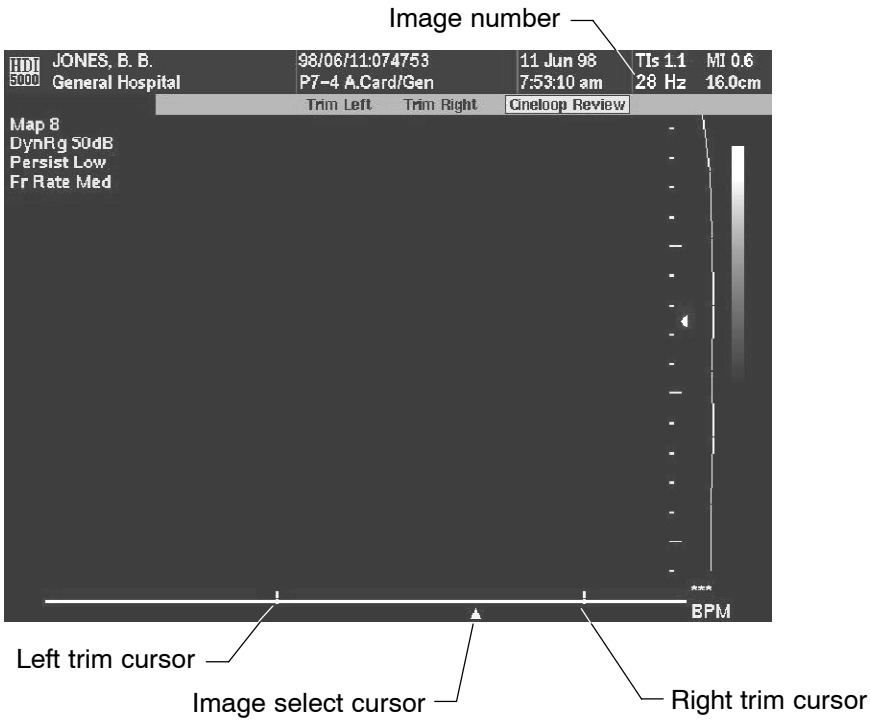


Figure 4–28. Cineloop Image Review

The Cineloop sequence can be played back to simulate real-time motion, or it can be reviewed a single image at a time. Each image is identified by a number located in place of the frame rate value at the top of the display and by the image select cursor. If the ECG display is on, then the location of the image in the Cineloop sequence corresponds to the image indicator on the ECG display and the image number is not displayed. The image number relates the image to its position in the Cineloop sequence relative to the first and last images of the Cineloop sequence, in the absence of an ECG display. The trim cursors limit the Cineloop sequence (Figure 4–28). Once enabled, the trackball moves the trim cursors and the **SELECT** control selects between them. The right trim cursor corresponds to the most recent frame captured.

With the Image Management option, pressing the **FREEZE** control enables the **CAPTURE** softkey. Pressing the **CAPTURE s**oftkey allows you to store the contents of the Cineloop buffer. The captured loop is then transferred from image memory to the system hard disk and the selected archive devices. At the completion of the loop capture, the system displays the last frame of the Cineloop buffer. For more information about storing loops or images, see the "Image Management" section.

M-Mode Review

Pressing **FREEZE**, during M-mode operation, initiates M-mode review. Moving the trackball to the left scrolls the M-mode data across the screen, displaying the M-mode data saved in the system memory. You may alternate between M-mode review and Cineloop image review by pressing the **SELECT** control. Pressing the **SELECT** control also displays the trackball menu, which shows the trackball assignment.

Doppler Review

During Doppler acquisition, when you press **FREEZE**, the system is automatically set to display the Doppler review buffer. When you press **FREEZE**, the scrolling display stops, and the trackball is assigned to the review. When you move the trackball to the left, the spectral data moves back through the most recently acquired spectral data.

During Doppler acquisition, changing certain Doppler control settings can change the Doppler scaling. The change in Doppler scaling is not easily discernible during Doppler review. Since calculations based on inconsistent Doppler review data would be erroneous, the system automatically blanks the display and clears the Doppler review memory buffer of data when Doppler scaling changes. Changing the following blanks the display and clears the memory buffer:

- PRF
- Baseline
- Spectral Invert
- Sweep Speed
- Display Format
- Steer (linear array)
- All mode changes

With the High Q automatic Doppler display, more flexibility exists with Doppler review. Regions of interest can be defined within the Doppler review buffer for which selected calculations can be displayed.

Dual Images

The **DUAL** control displays two 2D images side by side on the screen (Figure 4–29). Using the **UPDATE** control then allows you to toggle between the two images: the flashing **ATL** orientation marker indicates the active or live image. Measurements can be performed on dual images, if the images have the same magnification scale.

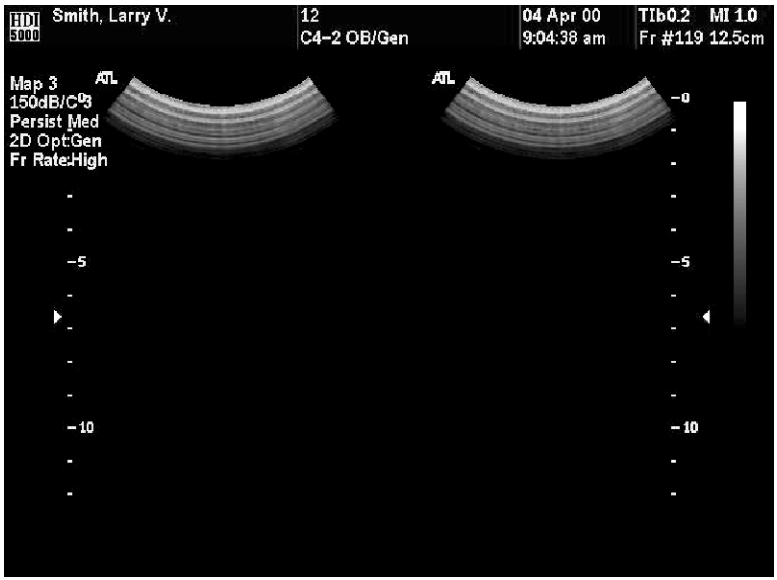


Figure 4–29. Dual Images

Biopsy Guideline and Depth Marker

A biopsy guideline and depth marker can be turned on and off from the **2D/MMode** menu, or you can use the **Superkey** and the **Biopsy** key. A biopsy guide appears only on the 2D display (Figure 4–30).

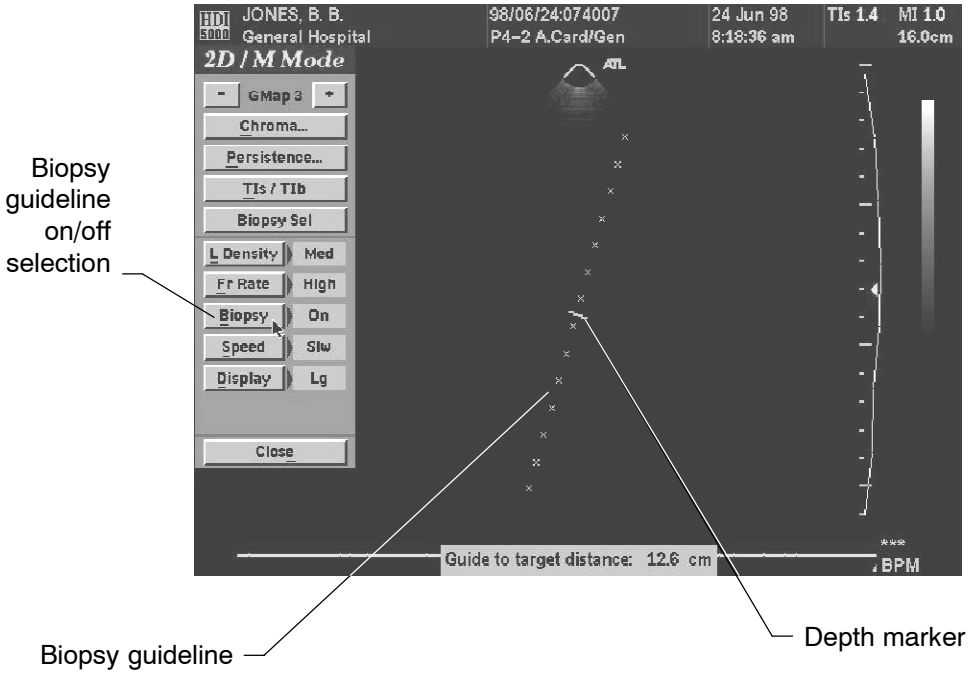


Figure 4–30. Biopsy Guideline and Depth Marker

Contrast Specific Imaging (CSI)

Contrast Specific Imaging (CSI) refers to the use of contrast agents for the purpose of image enhancement. When the contrast agent, which consists of micron-sized gas bubbles, or microbubbles, is introduced into the bloodstream, it creates a strong echogenic region. When the microbubbles are interrogated by the ultrasound, they begin to oscillate and emit a wide range of frequencies, including the fundamental frequency of the incident ultrasound, and its harmonic at twice the fundamental frequency. Conventional imaging tunes the receivers to the fundamental frequency returned, while harmonic imaging tunes the receivers to the harmonic frequency returned from the microbubbles. Since microbubbles generate more harmonic energy than does tissue, harmonic imaging selectively enhances the return from the microbubbles.

The appropriate choice of imaging mode depends on the clinical application. Also, since the contrast agent microbubbles are destroyed by the ultrasound, slowly moving blood is more effectively imaged using ECG triggering. CSI allows the user to combine harmonic and fundamental imaging with or without ECG triggering for a wide variety of applications. Since many clinical applications are still being researched, you are encouraged to follow the latest literature in the field relating to any given application.

Due to the nature of the microbubbles, the transmitted acoustic output level has a marked impact on the level and duration of the enhancement of the contrast agent microbubbles. System acoustic output power should be varied to achieve the desired results with CSI. Because the microbubbles provide potential cavitation sites, adherence to the ALARA principle is important.

Refer to the following references for information about Contrast Specific Imaging:

Nanda, N., Schlief, R., Editors. *Advances in Echo Imaging Using Contrast Enhancement.* Kluwer Academic Publishers, Dordrecht, The Netherlands, 1993.

Clinical Radiology, A Journal of the Royal College of Radiologists, Vol. 51, Supplement 1, February 1996, Ultrasonographic Echo-Enhancing Agents.

Cardiology CSI

The Cardiology CSI clinical option is available on selected scanheads. With the exception of Pulse Inversion 2D Harmonic, all Tissue Specific presets differ only in the signal processing used for Power Harmonic Imaging. When using Power Harmonics, you are encouraged to try the different settings to see which works best for the agent and clinical application being used.

General Imaging CSI

The General Imaging CSI clinical option provides this capability on the C5–2 scanhead only. Due to inconclusive reports on the value of Power Harmonics for General Imaging, it is not currently offered.

Pulse Inversion 2D Harmonic has, in some cases, been reported to produce particularly good results in the abdomen when used in real time at very low power levels, at a Mechanical Index (MI) of about 0.3.

Harmonic Imaging

Harmonic imaging is the reception and processing of harmonic frequencies generated by tissue. The harmonic frequency is twice the fundamental or transmit frequency. Harmonic imaging enables a dramatic reduction in image artifacts, reduces haze and clutter, and significantly increases contrast resolution and improves border delineation. Harmonic imaging excludes the fundamental frequency, which typically contains artifacts.

Harmonic imaging is often useful on difficult-to-image patients. The system is set to focus on harmonic echoes produced by tissue and ignore the transmitted fundamental frequency, which can create false echoes in difficult-to-image patients.

In 2D imaging, press the **HARMONIC OPTIMIZATION** control to enable harmonic imaging. The display indicates harmonic imaging is active with **2D Opt:HRes**. Pressing **2D/ COLOR OPTIMIZATION** stops harmonic imaging and returns the system parameters to one of the following settings:

- **2D Opt:Pen** optimizes the system to improve penetration.
- **2D Opt:Res** optimizes the system to improve image resolution.
- **2D Opt:Gen** optimizes the system for generic.

Power Harmonic Contrast Imaging

Power Harmonic Contrast imaging uses a color overlay to display the power of the Doppler signal returned from the contrast agent at the harmonic frequency. The use of the harmonic signals reduces motion artifacts from moving tissue allowing sensitive visualization of the contrast agent. Power Harmonic Contrast Imaging is enabled by pressing the **PWR** control when using any CARD CSI Tissue Specific preset, except Pulse Inversion 2D Harmonic.

Pulse Inversion 2D Harmonic Imaging

In Pulse Inversion harmonic imaging, a pair of inverted pulses are transmitted into the tissue that contains a contrast agent. The resulting backscatter signal from the two pulses is added, eliminating the fundamental and enhancing the second harmonic. The resulting enhancement to the 2D display results from the broadband transmission and reception that pulse inversion allows.

Pulse inversion harmonics is enabled when Pulse Inversion 2D Harmonics is selected from a CSI clinical option. When pulse inversion is first selected, it defaults to fundamental operation, not pulse inversion. Press the **HARMONIC** control to optimize the system for pulse inversion operation.

An important control that affects pulse inversion imaging is the **FR RATE** control, accessible on the **2D/MMode** menu (or by pressing **Superkey** and **Fr Rate**). The time between the two pulses used for pulse inversion imaging is varied. At lower frame rates, the system is more sensitive to contrast but also more sensitive to motion artifacts, due to the longer time between the pulses, which results in incomplete fundamental cancellation. At higher frame rates, it is slightly less sensitive to contrast but also less sensitive to motion artifacts.

SonoCT Real-time Compound Imaging

Compound imaging is selectable during grayscale imaging when you are using the L12–5 38 mm and the L12–5 50 mm scanheads. This option uses special transmit and receive echo beamforming to gather echoes from anatomy at several angles in real-time. Using this method, echo artifacts are more easily identified and discarded by the system during signal processing.

Alternating between 2D and Compound imaging may change the number and position of the focal zone indicators. **FOCUS** and **ZONES** operate the same as in 2D imaging, but focal zone indicators are different in Compound imaging (Figure 4–31). Other 2D imaging controls function normally while in Compound imaging. When Compound imaging begins, the image information indicates **Fr Rate:Surv** or **Fr Rate:Targ**. Pressing **FR RATE** alternates the image information between **Fr Rate:Surv** and **FrRate:Targ**. Each setting has a different ultrasound beam scanning geometry. Select the one that gives you the best image quality.

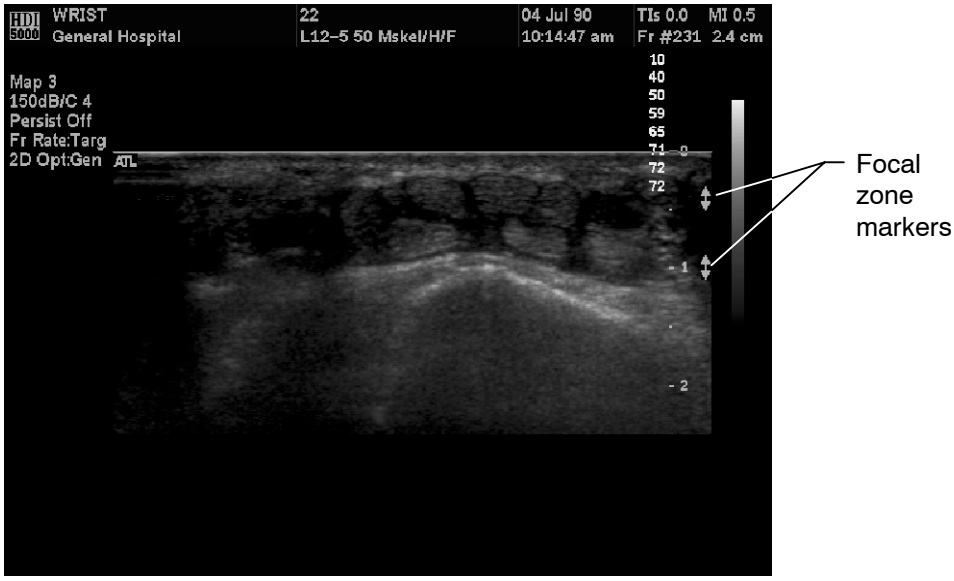


Figure 4–31. Compound Imaging Focal Zone Markers

Tissue Doppler Imaging

For specific scanheads, Tissue Doppler Imaging (TDI) is a Color Doppler imaging technique used primarily in cardiology to display ventricular wall motion. It uses a color overlay to display the high-amplitude, low-velocity Doppler signals from tissue motion. TDI is an extension of Color imaging. In Color imaging, the blood flow signal is displayed; in TDI, the tissue motion is displayed. TDI can also be displayed in M-mode imaging, and the Doppler image can be adapted to display tissue motion. The TDI display uses color to display the average velocity of the tissue parallel to the direction of the insonifying sound beam. The TDI M-mode display presents a sweeping display with depth on the vertical axis and time on the horizontal axis. The TDI M-mode display consists of color data representing the velocity of the tissue along the M-line. When TDI is used with pulsed wave Doppler, the system optimizes Doppler imaging for the display of tissue. There is no wall filter control in TDI. The **TDI** control enables and disables TDI.

In Color imaging, press the **TDI** control to enable TDI. In TDI, the scanhead is set to concentrate on strong, low-velocity echoes produced by moving tissue. The system filters out weaker echoes from blood cells. This optimizes imaging for wall motion studies. Pressing the **2D/COLOR OPTIMIZATION** control will cycle through **Tissue Opt:Pen**, **Tissue Opt:Res**, and **Tissue Opt:Gen**. Image processing parameters adjust as follows:

- **Tissue Opt:Res** optimizes the system for image resolution.
- **Tissue Opt:Gen** is the general or default setting.
- **Tissue Opt:Pen** optimizes the system for penetration.

High PRF Doppler Imaging

High PRF is useful when normal pulsed wave Doppler imaging cannot adequately display high-velocity or high-frequency signals. In high PRF, additional sample volumes are displayed as the depth of the sample volume of interest is increased (Figure 4–32). The extra sample volumes provide points of reference that can be discounted when analyzing the Doppler data. As the range of each sample volume area is extended to the next sample volume area, the display scale and the Doppler parameters change to reflect the higher display possibilities. An advantage of high PRF is the detection of increased velocity or frequency without aliasing, a disadvantage is range ambiguity, due to the unwanted sample volumes included in the Doppler signal.

To avoid noise bands or a loss of sensitivity caused by bright reflections while in high PRF, one or a combination of the following can be effective:

- Vary the velocity range to change the secondary sample volume position.
- Reduce the velocity range to remove the secondary sample volume.
- Reduce gain.
- Vary 2D image orientation.
- Change the acoustic window.

Scanheads that are capable of high PRF Doppler imaging automatically assume high PRF operation. Multiple sample volume cursors will appear on the 2D display as the PRF is increased with the **SCALE** control at sample volume depths ranging from 5.5 cm to 6.5 cm.

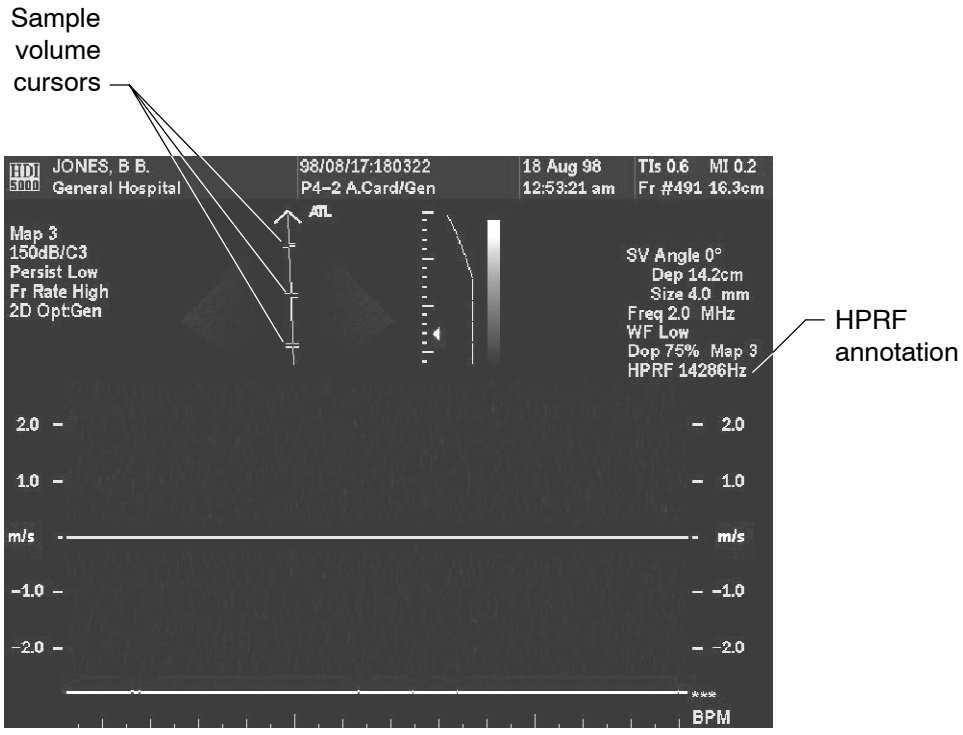


Figure 4–32. High PRF Doppler Display

3D Imaging

WARNINGS

- 3D is considered qualitative in nature. Quantitative measurements must not be made on the ultrasound system from 3D images.
- Do not calibrate a VCR or DiskLink 3D image.
- Do not carry forward previously-obtained 2D calibration information to a 3D VCR or stored DiskLink image.

3D volume data can be acquired using a freeform technique (uncalibrated acquisition) or using a 3DI Position Sensor (calibrated acquisition). For information about calibrated 3D acquisition, using the 3DI Position Sensor, refer to the *Advanced 3DI Reference Manual.* You can also use a MPT7–4 transesophageal scanhead for calibrated acquisition, but you must transfer the 3D volume data to an MO disk or to an off-line workstation for viewing.

A consideration in acquiring 2D images for 3D volume rendering is the high frame rate that is often used in 2D imaging. It often takes several trials, adjusting the sweep speed of the scanhead and the frame rate of the system, to get a complete 2D series for the 3D volume.

Adjust the line density and frame rate settings of the system and add focal zones to change the frame rate. A good goal is to get a frame rate in the 10–15 frames/sec range and practice at that frame rate. Use the Cineloop trim function, as necessary to adjust the size of the Cineloop review.

The frame rate for Color Power Angio (CPA) imaging or Color imaging is determined by the size of the color box and the line density and sensitivity settings. These settings can be adjusted to obtain an optimal frame rate.

Uncalibrated 3D Aquisition

The system uses the 2D images acquired and stored in Cineloop review to create a 3D imaging display. The 2D images acquired when you move the scanhead over an anatomical region are rendered by the system to create an apparent 3D image.

Because the 3D imaging display is derived from the acquisition of 2D Cineloop review images, and for ease of access, the 3D and Cineloop controls are both available from the **3D/CINE MENU** control.

Before creating a 3D image, you can set the following parameters from the **Cineloop®** menu (Figure 4–33):

- **Views** selects 1, 5, 7, 11, or 15 images as the number of images from which the 3D image will be rendered. The fewer number of images you select, the faster the 3D image will be rendered. The more images that you select, the smoother the motion of the 3D image will appear.

- **Slice** selects a thin, medium, or thick slice thickness for the 3D image rendering. If you take a relatively long time to move the scanhead you will want a thin slice setting. If you take a relatively short time to move the scanhead, then you will want a thick slice setting. Medium falls between the two. You will need to perfect your technique to determine which setting is right for you. The thicker the slice, the thicker the image appears.

Figure 4–33. 3D Imaging

To prepare for uncalibrated 3D acquisition, in 2D imaging, you begin by pressing the **3D UNCAL** softkey to clear the Cineloop review memory. A memory indicator appears on the screen. You want to move the scanhead across the anatomy of interest at about the same speed at which the memory indicator moves from one end of its display to the other end, ensuring that you move the scanhead in one direction across the anatomy of interest. When you have swept the area of interest with the scanhead, you press the **FREEZE** control.

The 2D images that you acquired, while moving the scanhead, are stored in Cineloop memory. On the **3D/CINE** menu, there is a **Create 3D** selection. Pressing **Create 3D** results in the system creating a 3D image from the 2D images that you acquired. This process is called rendering.

Uncalibrated 3D acquisition is dependent on the way in which the scanhead moves across the region of interest. Moving the scanhead too slowly, too quickly, or erratically will affect the appearance of the 3D image. You must move the scanhead at a constant rate. Technique is important in 3D image acquisition; a little practice may be necessary to develop this technique.

You can switch between 2D and 3D imaging, using the **Cine** on the **3D/CINE** menu.

Uncalibrated acquisition is the gathering of a series of image frames in which the spatial relationship between frames is assumed, rather than measured, as it is in calibrated acquisition. The ultrasound system assumes a series of equally spaced image slices. The goal, when acquiring a series for volume rendering, is to fill the Cineloop image memory with a spatial series of 2D slices by dragging, pivoting, or rotating the scanhead across the region of interest. As each new image frame is generated by the ultrasound system, the position of the scanhead should be over the next adjacent slice of tissue in the series. Move the scanhead at a constant speed so the frames are equally spaced.

" **To create an uncalibrated 3D image sequence:**

1. During 2D or CPA imaging, scan the area of interest.
2. Move the scanhead across the area of interest to establish the desired angle and position of the scanhead.
3. Press the **3D UNCAL** softkey to clear the Cineloop memory. A 3D memory indicator is displayed beneath the image. (Figure 4–34).

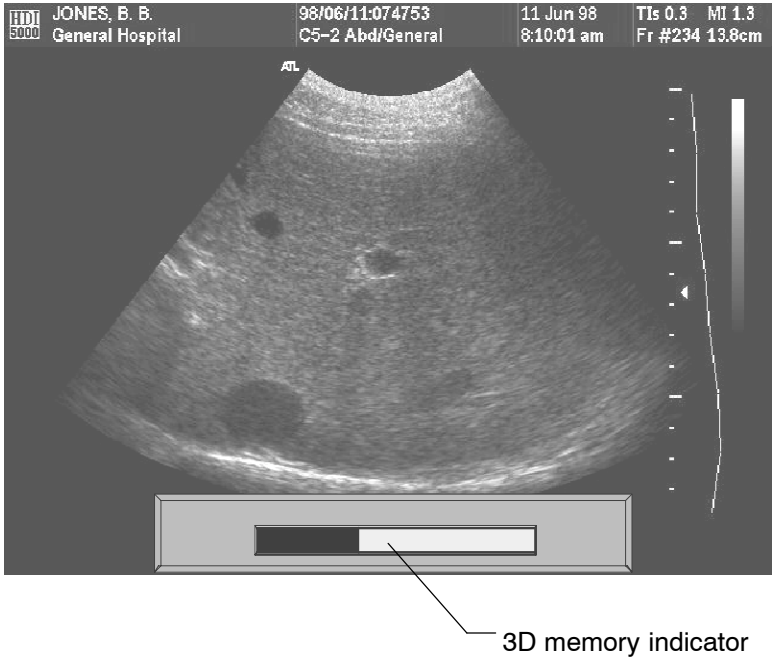


Figure 4–34. 3D Memory Indicator

4. Scan the area of interest, moving the scanhead in one direction in a smooth manner. Move the scanhead at the same rate as the 3D memory indicator.
5. When you have moved the scanhead over the area of interest, press the **FREEZE** control.
6. Press the **3D/CINE MENU** control. The **Cineloop r** menu appears.
7. Use the trackball, the **SELECT** control, and the controls on the **Cineloop r** menu to trim the Cineloop sequence.
   a. In pause, select **Trim**. The Cineloop graphic appears with the left trim cursor displayed.
   b. Use the trackball to trim the Cineloop sequence from the left.
   c. Select **Trim Right** from the trackball menu.
   d. Use the trackball to trim the Cineloop sequence from the right.
   e. Continue to select **Trim Left**, **Trim Right**, and **Cineloop Review** to adjust the Cineloop sequence.
   f. Select **Pause/Play** from the **Cineloop r** menu to play the Cineloop sequence.
   g. After you have the 2D Cineloop sequence that you want, proceed as follows.

8. On the **Cineloop r** menu, select the number of images (**Views**) and the slice thickness (**Slice**) for the rendering of the 3D image display.
9. On the **Cineloop r** menu, select **Create 3D** to create the 3D image. The loop memory indicator provides status during the time the system is creating the 3D image (Figure 4–35).
   – To stop the creation of the 3D image, select **STOP** on the loop memory indicator.

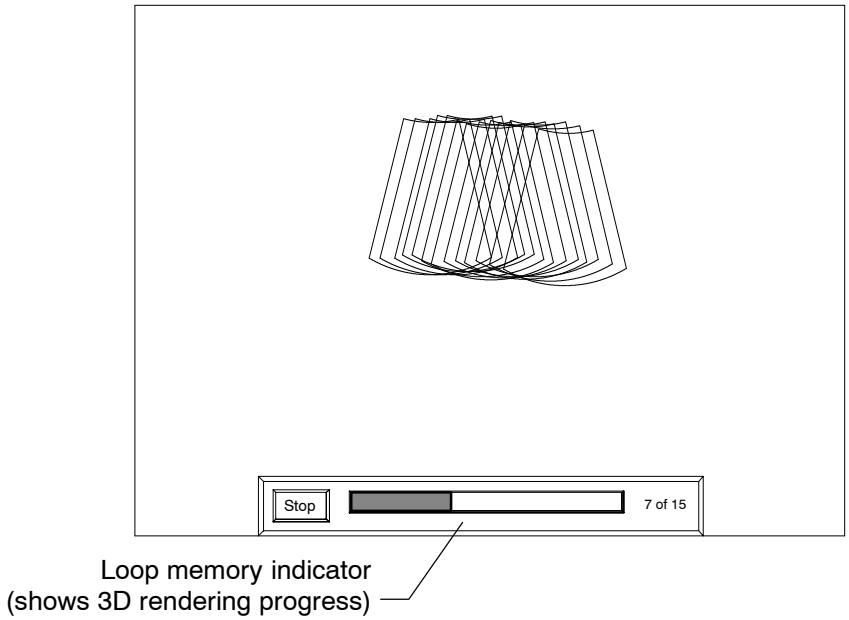


Figure 4–35. Creating a 3D Image

10. When the system has created the 3D image, 3D Cineloop playback automatically begins.
11. Use the **CINE/3D** menu controls to change the speed of the playback, to alternate between sweep or loop, and to alternate between 2D and 3D imaging.
    - Select **Pause/Play** to alternate between play and pause.
    - While the 3D sequence is replaying, select **+Speed** or **–Speed** to vary the speed.
    - Select **Sweep/Loop** to alternate between sweep and loop. Note that the type of playback, sweep or loop, is annotated in the annotation area at the top of the display in place of the frame counter.
    - Select **Cine 2D** or **3D** to alternate between the two.
12. Select **Close** on the **CINE/3D** menu to close it.
13. Press **FREEZE** to start real-time imaging.

Calibrated 3D Acquisition with the MPT7–4 Scanhead (3D Cardiology Option)

The **3D Calib** menu has selections you can use to calibrate the system to acquire the 3D images according to the demands of each exam. The **3D Calib** menu appears after you press the **3D CALIB** softkey.

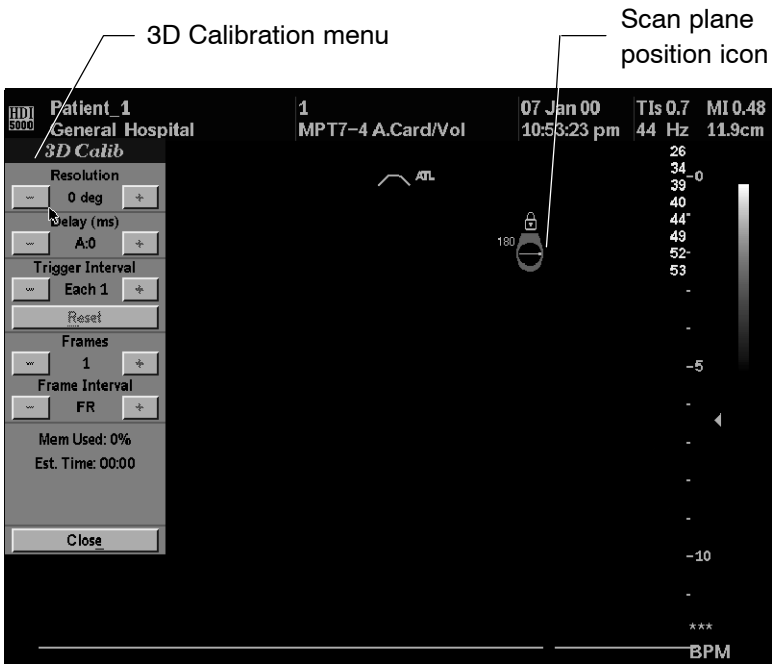


Figure 4–36. 3D Calibration Menu

- **Resolution** defines the number of degrees the transducer rotates after capturing each cardiac cycle, as it moves through the area of interest. The degrees are set to whole numbers that are divisible into 180. The range is from 3 degrees to 30 degrees. Setting the resolution to 3 degrees results in 60 image loops of one cardiac cycle each, giving the best spatial resolution. A 30-degree setting produces only 6 scan planes of image sequences, a reduction in resolution, but requires much less time to capture and store all the images necessary for a complete cardiac cycle.
- **Trigger Delay** defines the time delay between the patient's R-wave and the beginning of the first captured image. The delay can be set in 20 millisecond increments from 0 to 2,000.
- **Trigger Interval** defines the number of cardiac cycles the system ignores between triggered acquisitions. The number of cardiac cycles can be set from 1 to 20, 25, 30, 40, and 50.
- **Frames s**ets the number of frames captured per incremental rotational movement of the scan plane. (The incremental movement is set using the **Resolution** setting.) The number of frames can be set from 1 to 20 for 2D and 1 to 10 for Color. The maximum number of frames depends on the size of the captured frames and the amount of image memory available. To increase the number of captured frames, decrease the frame size.

- **Frame Interval** defines when the frames are captured during the cardiac cycle. The following settings can be selected:
  - **FR** (Frame Rate) captures images at a rate determined by the system. You set the number of frames captured during the cardiac cycle. This setting is recommended for irregular cardiac cycles. Initiates capture immediately after a trigger.
  - **Delay(ms)** captures the user-defined number of frames at the system frame rate and adds a user-defined delay (spacing) between frames. The delay is in 20-millisecond increments from 20 milliseconds to a maximum value that is dependent on the number of captured frames, patient heart rate, and system frame rate.
  - **Even** allows capture of the user-defined number of frames spaced evenly over the entire cardiac cycle.
  - **Systole** allows capture of as many frames as possible during half of the cardiac cycle. Mostly used during systole, but may be used to capture either half of the cardiac cycle.
  - **R–R** allows capture of the maximum number of frames over the entire cardiac cycle. The maximum number of frames is determined by the system.
- **Mem. Used** indicates the percentage of image memory used based on current acquisition definition.
- **Est. Time** displays the estimated amount of time elapsed during the capture period.
- **Close** exits the 3D calibration process.

" **To calibrate the system for 3D acquisition with MPT7–4 scanhead:**

1. Press **3D CALIB**. The **START** and **CANCEL** softkeys and the **3D Calib** menu appear (Figure 4–36).

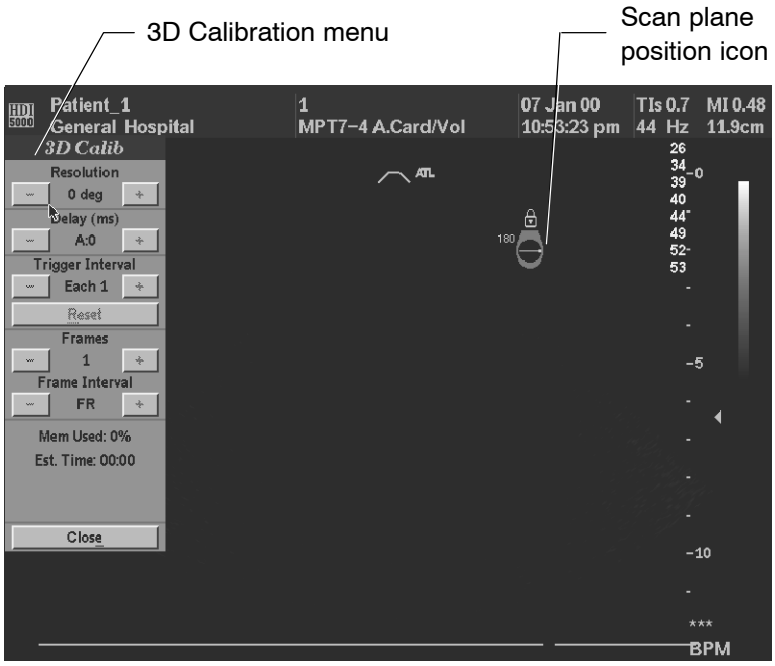


Figure 4–37. 3D Calibration

2. On the **3D Calib** menu, select the settings for your 3D acquisition.
3. Select **Close**. The **3D Calib** menu is removed and your settings are applied.

" **To acquire and store a calibrated 3D image sequence with the MPT7–4 scanhead:**

1. Connect ECG leads from the system to the patient.
2. Calibrate the system as described in “To calibrate the system for 3D acquisition.”
3. Ensure a strong, consistent ECG trace with reliable triggering to the cardiac cycle.
4. Position the scanhead and optimize image quality. (To adjust image quality, press **CANCEL**, as necessary, to access the 3D controls and menus.)
5. Verify the region of interest is centered in the image display. (If necessary, see the “Transesophageal Scanheads” section of the *Scanheads and Safety* manual.)
6. Press **3D CALIB**. The **START** softkey appears.

7. Press **START** to acquire a 3D image. The MPT7–4 scanhead rotates the transducer and imaging begins. The scan plane position icon on the display rotates through the 180-degree arc (Figure 4–36).
   - Press **PAUSE** to temporarily stop acquisition.
   - Press **RESUME** to resume acquisition.
8. The imaging sequence is complete when the scanhead has rotated and imaged all scan plane positions. The **STORE VL** and **LABEL VL** softkeys appear.
   - Press **STORE VL** to store the acquired series of images.
   - Press **LABEL VL** to label the image sequence before transfer, then select **Store Volume** to store the sequence.

   The image is stored to either the optical disk or the workstation, depending on the system setups. (Refer to "To change the 3D image storage destination" in the "Image Management" section.)
9. Press **FREEZE** to exit 3D acquisition.

Physio

Electrocardiography (ECG)

The electrical activity that controls the heart muscle can be detected and displayed by an electrocardiograph (ECG). Detection of this electrical activity is accomplished by placing electrodes on the patient and amplifying the resulting potentials. These potentials create a waveform known as the electrocardiogram or ECG. The ECG waveform can be used as a reference for cardiac timing.

The system provides ECG monitoring capability. The ECG receptacle is a Lead II configuration and is located to the left of the scanhead receptacles beneath the optical disk drive. For best results, the use of pre-gelled ECG disposable electrodes is recommended. The use of reusable electrodes is not recommended.

The Lead II configuration is based on the fact that the largest ECG potential on most patients is measured diagonally across the chest between the left leg (LL) and the right arm (RA). In this configuration the ECG amplifier is connected between the left leg lead and the right arm lead with the left arm (LA) lead serving as the ground reference connection (Figure 5–1).

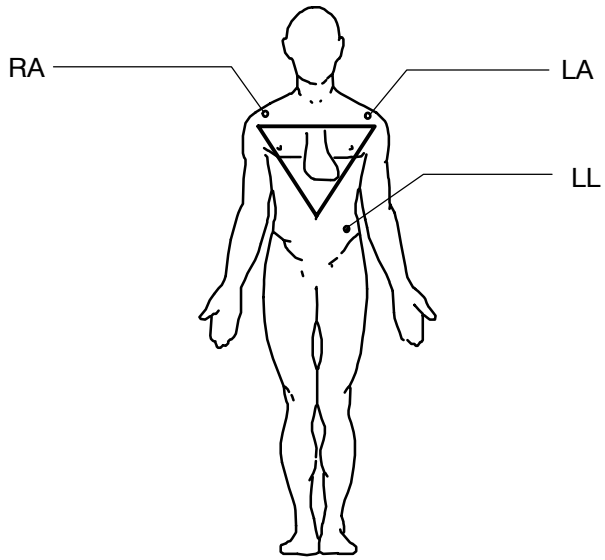


Figure 5–1. Lead II ECG Connections

A maximum ECG gain setting represents 20 mm/mV, and a minimum ECG gain setting represents 2 mm/mV. The default ECG gain setting is established at a value that can be used for most patients. If the ECG signal appears too weak, you may want to check the connections of the ECG leads before adjusting the ECG gain setting (Figure 5–2).

When they are turned on, the ECG triggers are represented on the ECG display as vertical cursors. They indicate the point in the heart cycle at which the 2D image is updated with a new frame of 2D information. There are two ECG triggers: A and B. Trigger A is located on top of the ECG trace; trigger B is located directly beneath the ECG trace.

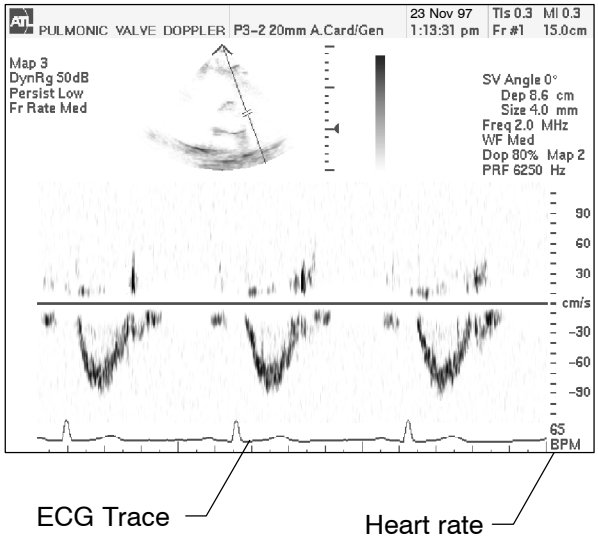


Figure 5–2. ECG Display

Heart Rate

The heart rate is displayed in the lower right corner of the video display (Figure 5–3). When the ECG display is turned on or off, the heart rate is correspondingly turned on or off.

The heart rate is averaged over 5 heart cycles and is a running average of the last 5 heart cycles. The heart rate is not updated when the system is frozen.

The ECG T-wave rejection for heart rate calculation, or the level at which the system ignores large T-waves relative to the R-wave, is at least sixty percent of the R-wave. Valid heart rates range between 24 and 250 beats per minute (BPM). Heart rates outside of this range will result in a null display indicated by three asterisks, ***.

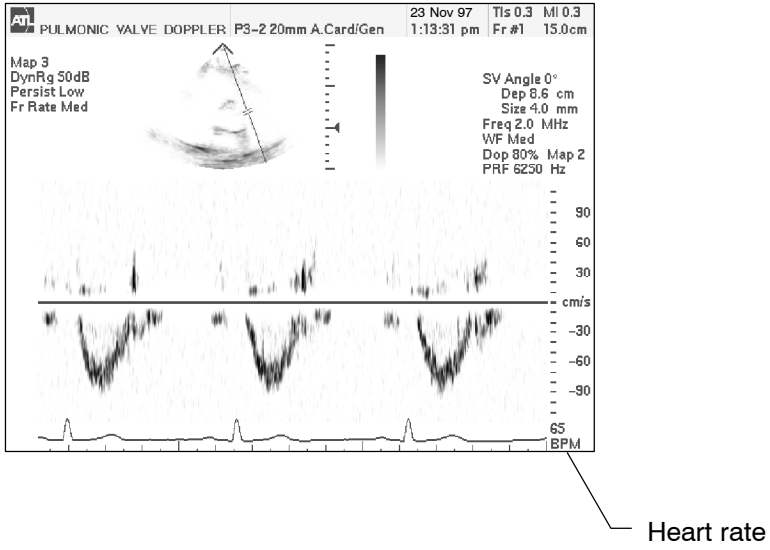


Figure 5–3. Heart Rate Display

High Level ECG

The system can display high level ECG from other sources (stress echo or cardiac care unit). The high level ECG receptacle is shown in Figure 5–4.

Pulse/Channel A

Pulse refers to the graphic recording of pressure changes related to blood flow. The pulse transducer contains a piezoelectric transducer that converts pressure fluctuations into an electrical signal for cardiac timing purposes. The pulse trace can be used alone, but the presence of an ECG, a phonocardiogram, or both provide relationships between events that are useful. Channel A may also be used for other auxiliary, physiological signals, such as respiratory monitoring or apexcardiogram.

The pulse transducer kit is required to take advantage of the physio capabilities of the system. A variety of pulse transducers are available and can be used on the system. Currently, the ones for which the system can be optimized are listed in the Physio setups. Before using Physio, ensure that the system is optimized for your pulse transducer.

The Pulse/Channel A receptacle accommodates a 1/4-inch phone jack connector (Figure 5–4).

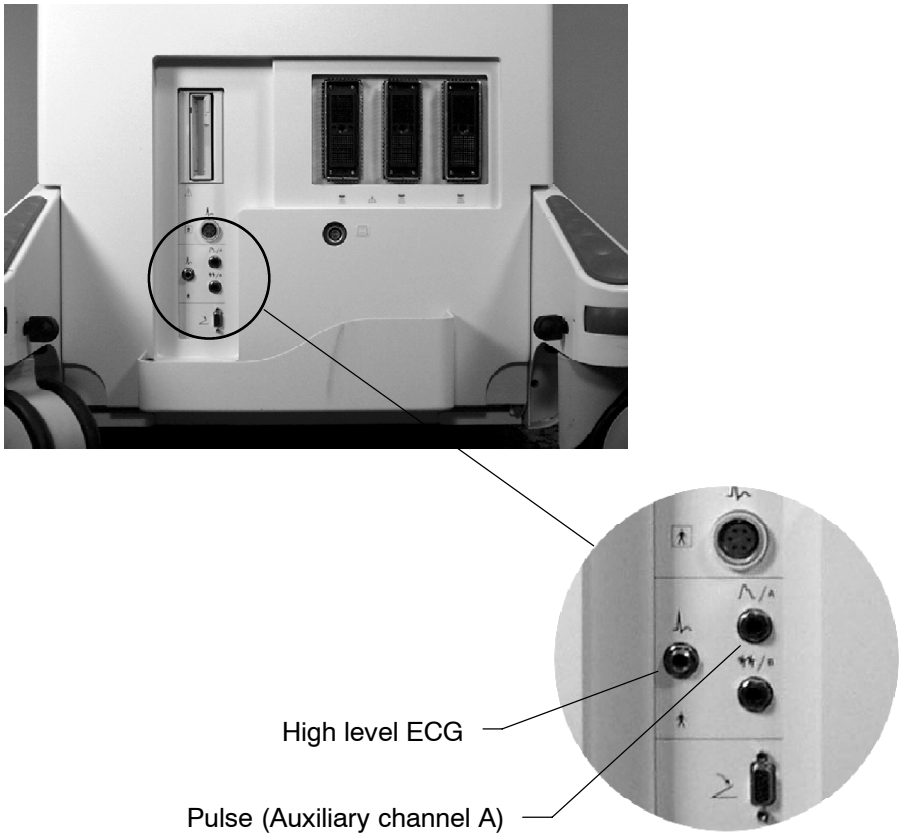


Figure 5–4. Pulse/Channel A Receptacle

Pulse Transducer Kit

A typical pulse transducer kit is shown in Figure 5–5. The pulse transducer converts pressure fluctuations caused by the pulse into an electrical signal for monitoring and recording purposes.

The pulse transducer can be hand-held. It is important that the pulse transducer housing be held firmly in place, especially for pulse and low amplitude pressures, as the signal is the result of the displacement of the pulse transducer tip with respect to the housing.

For routine pulse detection, there is a choice of direct and remotely-coupled pick-up funnels. The direct-coupled funnels plug into the transducer head, a pressure-tight connection being secured by an O-ring seal on the funnel spigot.

Remotely-coupled funnels are intended for use in situations where the transducer is difficult to manipulate, or where greater sensitivity of touch is required. The funnels are attached to the pulse transducer by a flexible coupler. The flexible coupler comprises a plastic tube and an O-ring sealed spigot which plugs into the pulse transducer head.

For situations where it is desirable to attach the pick-up funnel to the patient a flat-style funnel is also available. This unit is typically held in place with tape.

In addition, the Physio setups provide a way for you to optimize the system for a specific manufacturer's type of microphone.

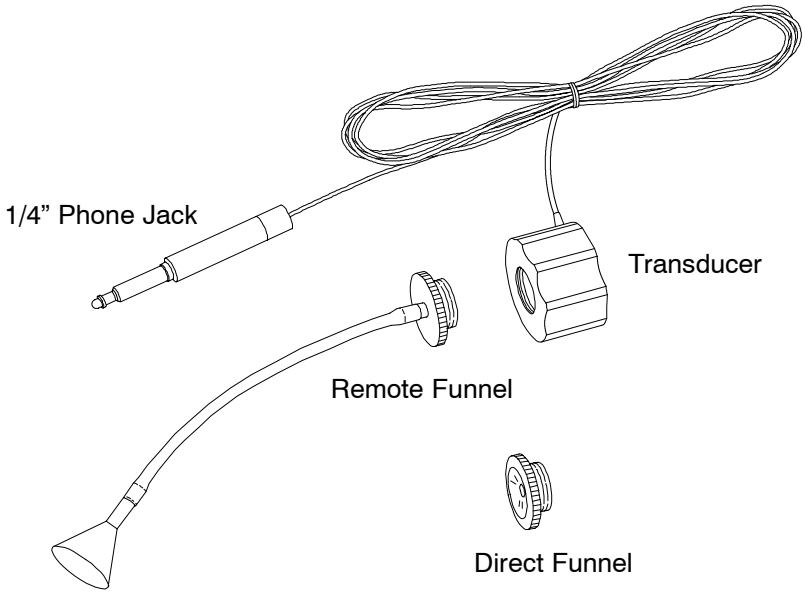


Figure 5–5. Pulse Transducer Kit

Phono/Channel B

Phonocardiography (PCG) or phono is the recording of heart sounds and their graphic display on the system video monitor. The system phono display may not display heart murmurs, and therefore should not be used for diagnosis of condition. The system phono display can be used to evaluate cardiac timing relationships. A pulse and ECG display would provide useful points of reference in this evaluation.

The Phono/Channel B receptacle accommodates a 1/4-inch phone jack connector (Figure 5–6).

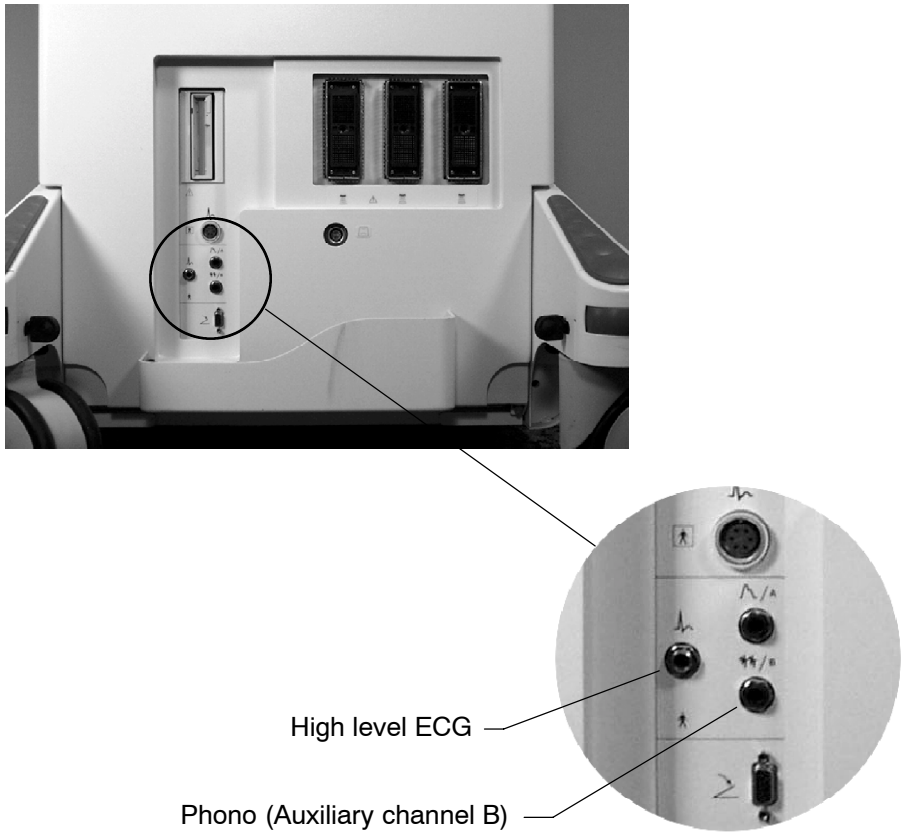


Figure 5–6. Phono/Channel B Receptacle

Phonocardiography (PCG) Transducer Kit

The system provides a receptacle, circuitry, and controls for the display of the phonocardiogram on the system monitor. In addition, the Physio setups provide a way for you to optimize the system for a specific manufacturer's type of transducer.

Channel B may be used for other auxiliary, physiological signals, such as respiratory monitoring.

A typical PCG transducer kit is shown in Figure 5–7. The adhesive pads are used to secure the PCG transducer to the patient (Figure 5–8).

Prior to securing the PCG transducer, use a stethoscope to locate the best placement for heart sound monitoring.

Figure 5–9 illustrates the locations on the body at which the different heart sounds can best be detected.

Figure 5–10 illustrates the timing and waveform relationships among some typical pulse, phono and ECG traces.

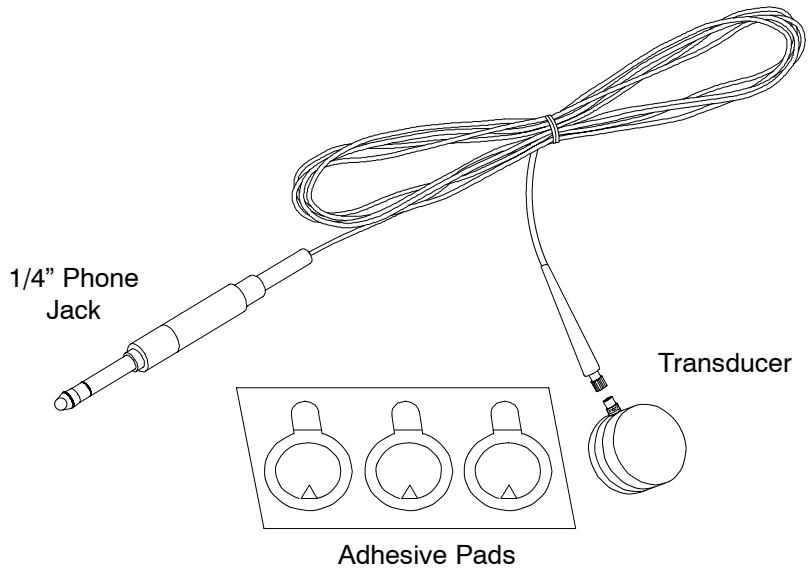
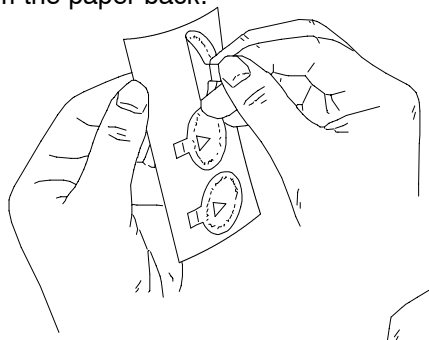


Figure 5–7. PCG Transducer Kit

1. Peel the adhesive pad from the paper back.



2. Place the adhesive pad on the PCG transducer, and carefully peel away the paper back.

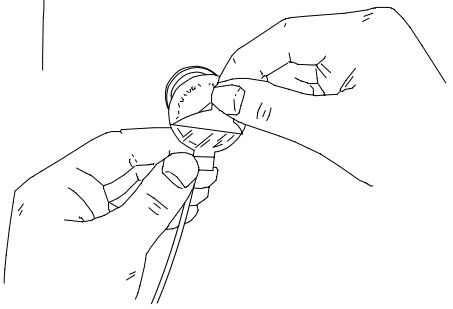


Figure 5–8. Preparing the PCG Transducer

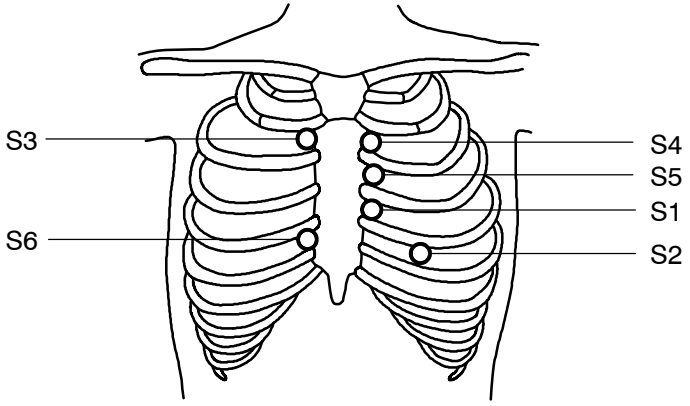


Figure 5–9. Heart Sound Locations: S1 through S6

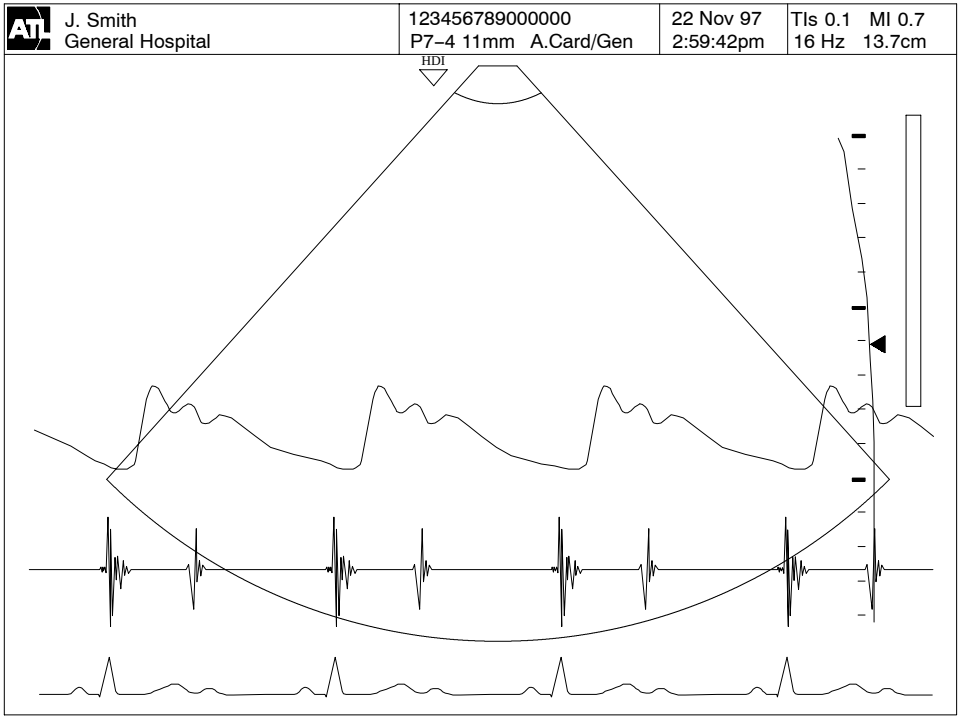


Figure 5–10. Physio Waveforms

Physio Controls

The **PHYSIO MENU** control provides access to the Physio controls. The Physio controls enable the desired physio display, adjust the gain, position physio traces on the video display, select the display size, and configure the display space (Figure 5–11).

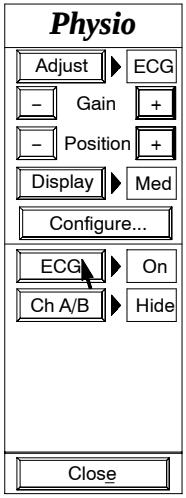


Figure 5–11. Physio Menu Controls

When you select **Adjust**, the selections that are available, if you have purchased auxiliary physio, are **ECG**, **ChA**, and **ChB**. Once you have selected the channel that you want to adjust, the **Gain**, **Position**, and **Display** selections will affect the selected channel.

Configure, on the **Physio** menu, provides access to submenus that correspond to the channel that you have selected with **Adjust**. Figure 5–12 through Figure 5–16 show the submenus available from the **Configure** selection and the locations of the traces on the video display.

The **ECG** and the **ChA/B** selections allow you to turn off the ECG trace or to hide the Channel A or Channel B traces (Figure 5–11). To display any of the physio traces, the ECG trace must be turned on.

ECG Controls

The delay or location of the triggers along the ECG trace is established with the respective delay controls on the **Triggers** menu, which is accessed by pressing the **TRIGGERS** control or selecting **Configure** on the **Physio** menu (Figure 5–12).

Once the triggers are located, you press the **UPDATE** control to activate ECG-triggered operation. The display will then update based on the trigger points that you have established. The frame rate in Hertz is removed during ECG-triggered operation. Trigger A is above the ECG trace, trigger B is below the ECG trace.

Using the **Trigger Interval Each n** selection, you can set the trigger interval for the A and B triggers. The choices are n equals 1 through 50. Both A and B triggers are affected; the trigger intervals cannot be set independently.

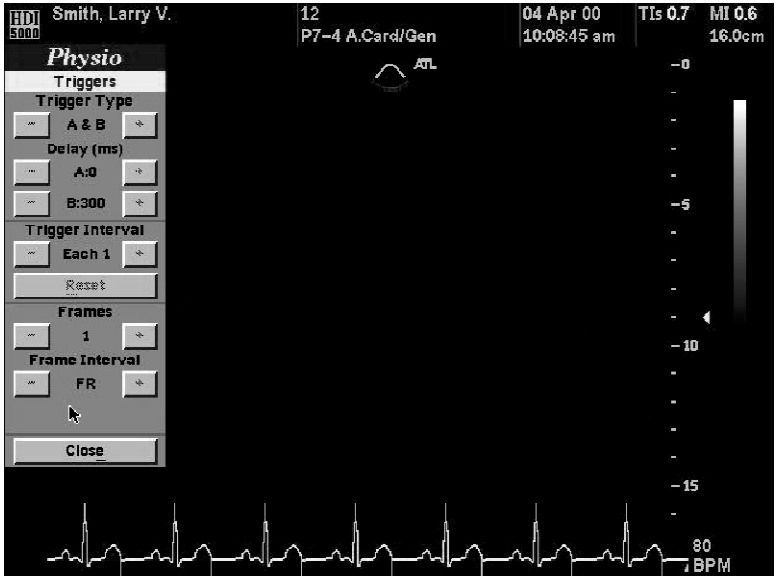


Figure 5–12. ECG, Triggers, and Triggers Menu

Channel A Controls

If **Adjust** is set to **Ch A**, selecting **Configure** displays the **Channel A** menu (Figure 5–13). The selections on this menu allow you to select the Channel A physio display or turn off Channel A. The selections are **Off**, Auxiliary (**Aux**), or **Pulse**. ECG must be turned on to display Channel A.

Figure 5–14 shows the location of a typical pulse trace from **Channel A** on the video display.

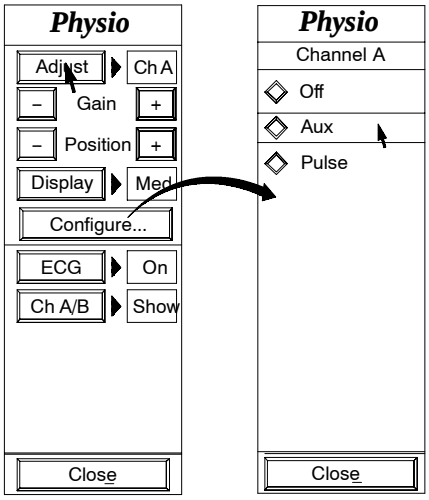


Figure 5–13. Channel A Menu

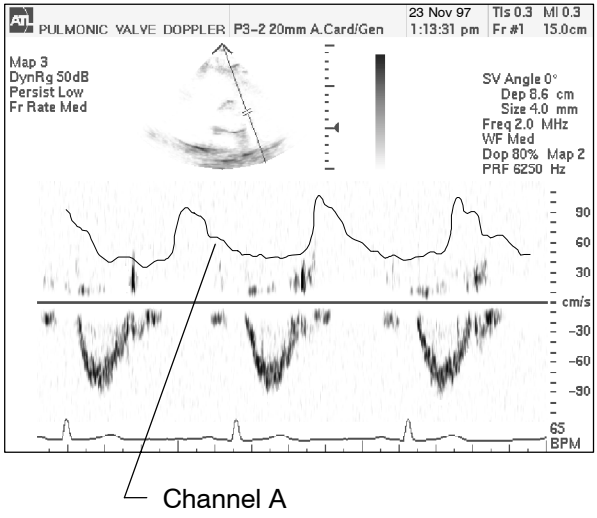


Figure 5–14. Channel A Display

Channel B Controls

If **Adjust** is set to **Ch B**, selecting **Configure** displays the **Channel B** menu (Figure 5–15). The selections on this menu allow you to select the Channel B physio display or turn off Channel B. The selections are **Off**, Auxiliary (**Aux**), or **Phono**. ECG must be turned on to display Channel B.

Additionally, there are four phono filter settings from which to choose: **Off**, **Low**, **Medium**, and **High**. Because the high-amplitude nature of the low frequency component of the signal can interfere with the display of the higher frequency signal components, you may want to filter out the low frequency component. The low, medium, and high settings provide increasingly more low-frequency filtering.

Figure 5–16 shows the location of a typical phono trace from **Channel B** on the video display.

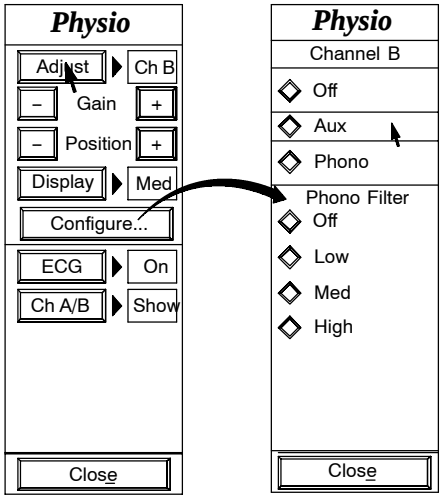


Figure 5–15. Channel B Menu

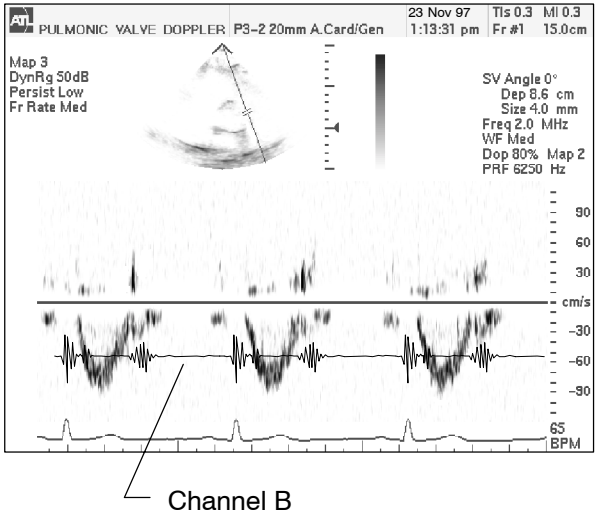


Figure 5–16. Channel B Display

Acquisition Triggering

Trigger Controls

The **TRIGGERS MENU** control provides fast setup of image acquisition timing. Press **TRIGGERS MENU** to display the **Triggers** menu of trigger timing selections. Selecting **Configure** in the **Physio** menu displays the same **Triggers** menu. You set most of the **Triggers** menu selections by selecting **+** or **–** (Figure 5–17).

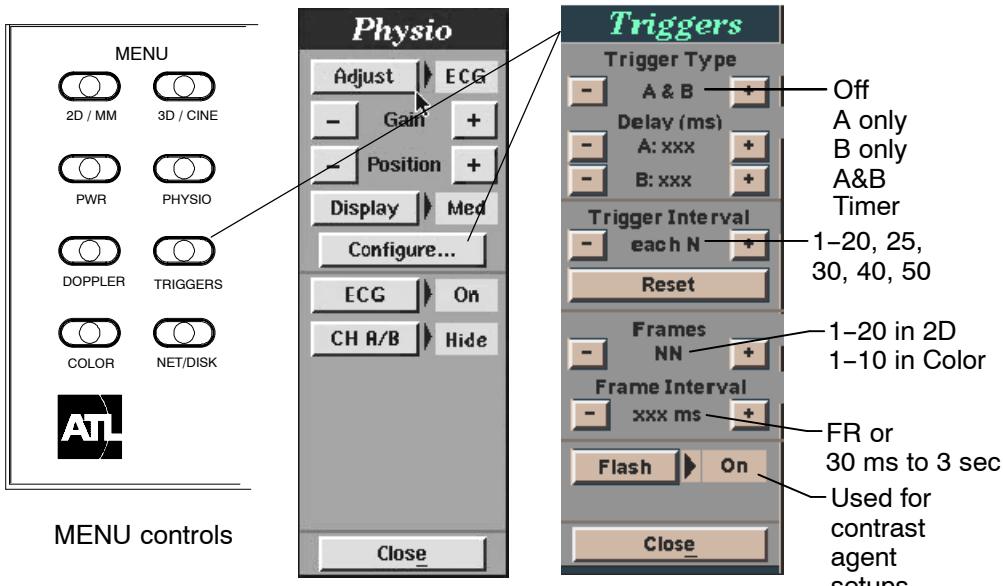


Figure 5–17. Physio and Triggers Menus

Trigger Type has two selections when ECG is set to Off: **Off** and **Timer**. When **Off** is selected, the triggers menu is disabled. When **Timer** is selected, only the A trigger is used, the B trigger is disabled, and other settings are active as described below. The following settings are selectable when ECG is on:

- **Off** grays out all the **Triggers** menu selections and triggering setup is disabled.
- **A only** allows a single trigger delay on the ECG to be set for an image acquisition sequence.
- **B only** allows a single trigger delay on the ECG to be set for an image acquisition sequence.
- **A&B** allows two trigger delays on the ECG to be set for an image acquisition sequence.
- **Timer** is an internal system clock used to start an image acquisition sequence.

Delay (ms) changes trigger delays in 20 ms steps and is also used to set the timer interval.

Trigger Interval Each N is used to skip triggers during acquisition, where **n** is a number that corresponds to the trigger interval. The selections range from 1 to 50. Press **Reset** to reset the trigger interval to **1**. (When the trigger interval is set to **1**, no triggers are skipped.)

Frames changes the number of frames for each triggered acquisition.

Frame Interval selects a delay between frames, if there are multiple frames for each trigger. The **FR** setting is the normal system frame rate.

Flash is displayed on the menu and is selectable when using clinical options that use contrast agents. When **Flash** is **On**, pressing the **UPDATE** control initiates a high-energy ultrasound pulse that destroys a contrast agent's bubbles in the area of interest. When the high-output duration is over, the system returns to a low-energy output, and the bubbles return to the area of interest. **Flash** is available only in 2D or Power imaging.

ECG Triggering

" **To use Flash:**

1. Select a scanhead and a Tissue Specific preset for the contrast agent you are using.
2. Select **2D** or **PWR IMG**.
3. Press **TRIGGERS MENU**. The **Triggers** menu appears.
4. Set **Trigger Type** to **Off**.
5. Select **Flash**. **Flash** indicates **On**.
6. Use the **OUTPUT** control to set the **MI** value to the normal imaging level specified for the contrast agent in use. The MI value is available from your contrast agent supplier or your ATL representative.
7. Press **UPDATE** and use the **OUTPUT** control to set the **MI** value, as viewed on the display, to the flash trigger level specified for the contrast agent in use. The MI value is available from your contrast agent supplier or your ATL representative.
8. For manual trigger operation, change **Trigger Type** to **Timer**.
   a. Be sure the **A** delay is set to **Manual.**
   b. Set the number of frames and frame interval as desired.
   c. Begin normal imaging at low-power MI, and administer contrast agent as appropriate.
   d. Press **UPDATE** for high-power flash imaging followed by low-power.
   e. Press **UPDATE** again for additional high-power flashes.
9. For automatic low/high power switching, set the **Triggers** menu as specified in the protocol supplied to you with the contrast agent.

" **To configure for ECG-triggered operation:**

ECG-triggered operation is available in 2D, 3D, Color imaging, Compound imaging, Power imaging, and is used for imaging with contrast agents.

1. Press the **PHYSIO MENU** control. The **Physio** menu appears.
2. Ensure the ECG display is **On**.
3. To adjust the ECG display, select **ECG**.
4. If necessary, change the ECG gain and position.
5. Press the **TRIGGERS MENU** control. The **Triggers** submenu appears.
6. Select the **+** or **–** to cycle through to your choice of **Trigger A**, **Trigger B**, or **A&B**.
7. To increase the delay of the ECG triggers, select **Delay (ms) A+** or **Delay (ms) B+** (Figure 5–18).

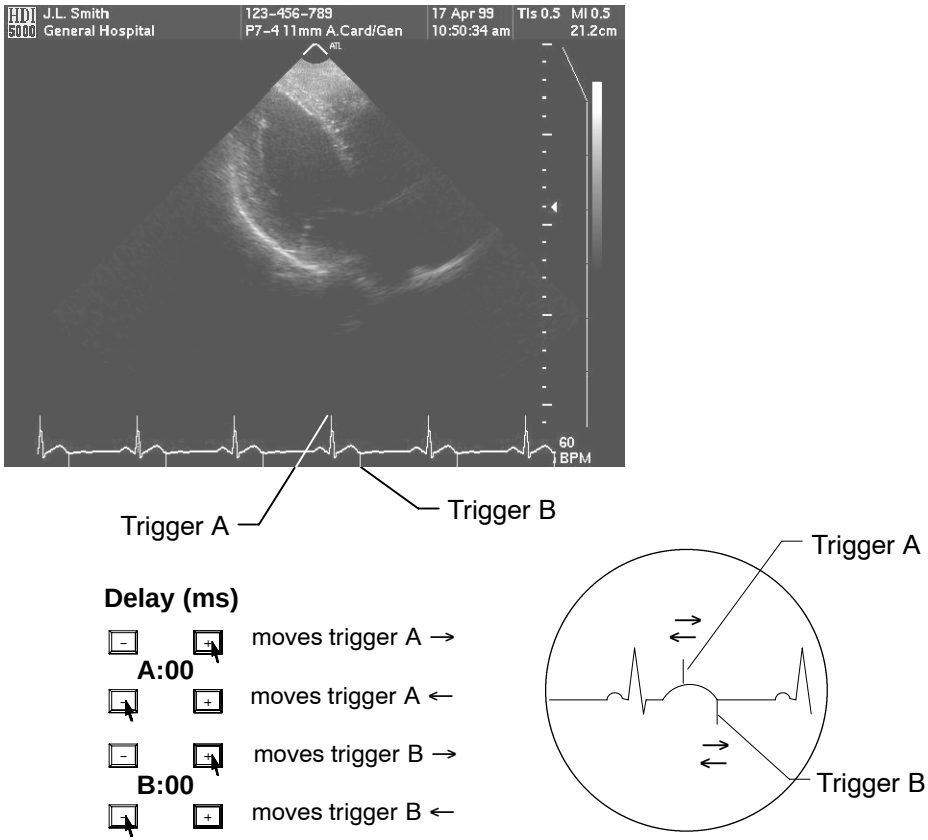


Figure 5–18. ECG Trigger Positioning

8. To decrease the delay of the ECG triggers, select **Delay (ms) A–** or **Delay (ms) B–** (Figure 5–18).
9. To skip ECG triggers, select **Trigger Interval Each N +** or **–** on the **Triggers** sub-menu.
10. To alternate between ECG-triggered acquisition and 2D imaging:
    - Press **UPDATE**
    - If you have a footswitch, press and release the **UPDATE** (middle) footswitch.

Measurements

Measurement tools are available for 2D, M-mode, Doppler, Color, and Power images. You use the measurement tools to perform measurements; the system uses your measurements to calculate results. Measurement calipers are represented visually on the screen as cursors. Normally, you rotate the trackball to move the cursors, and press the **SELECT** control to determine the measurement. The system uses your measurement to calculate a result. The results are displayed on the screen, or they can be entered into a calculations protocol. Protocols are discussed in the "Calculations" section.

Ensure that you follow current medical practices when identifying specific measurement points on an image.

Measurement Setups

The measurements setups are available from the **Directory of Setup Options**. The **Measurements** setups allow you to determine a default for the type of area method, volume method, High Q update, and the Doppler results display.

Measurement Tools

The measurement tools are located on the control panel.

DISTANCE starts a distance measurement.

AREA starts an area measurement.

ADV MEAS displays the **Meas Tools** menu from which you can select several different measurement tools.

- **Volume:** measures and calculates the volume of a displayed object, using the volume method selected in **Measurements** setups.
- **Volume Method**: selects a method to measure and calculate volume, regardless of the volume method selected in **Measurements** setups.
- **Vol (Volume) Flow**: measures and calculates volume flow for general imaging clinical options.
- **Cardiac Output** (CO): measures and calculates cardiac output and stroke volume for cardiology clinical options.
- **Heart Rate**: measures and calculates the heart rate.
- **Time/Slope:** measures time and slope on M-mode and Doppler displays.
- **Calibrate:** must be used before measuring any stored or recorded image.

- **Set Region**: displays measurement cursors to specify a region of the Doppler display for High Q automatic Doppler display calculations.
- **Mean Trace**: allows you to turn on or off the display of the mean Doppler trace function. **Mean Trace** is not available in Cardiology clinical options. (The **High Q** control turns the peak trace on or off.)
- **Trace**: allows you to choose which part of the spectral trace is used to calculate the High Q values: above the baseline, below the baseline, or from both above and below the baseline. The **Superkey Tr Dir** can also be used to set the High Q trace.
- Any additional optional measurement tools will appear at the bottom of the menu. Examples of optional measurement tools are **Hip Angle**, **d:D Ratio**, Percent **Diameter Reduction**, and Percent **Area Reduction**.

HIGH Q Automatic Doppler measurement initiates the automatic calculation and display of the specific values associated with the Doppler spectral waveform. The number of heart cycles selected in the **Measurements** setups for High Q automatic measurement and the Doppler Results Display setup values establish the parameters with which the High Q automatic measurement works and the results that are displayed.

DEL MEAS erases the most recent distance measurement or the most recent segment of an area measurement and erases all measurements.

All Points measurement tools appear on some protocols: the cardiology protocols and the Fetal M-mode protocol. All Points measurement tools are programmed sequences of system prompts that describe all measurement points required to make certain calculations. For example, in the **Fetal M-Mode** protocol, you are directed in one of the system prompts to “Position the cursor at the left IVS, press SELECT.” Performing the steps as indicated will complete the protocol and provide the range of measurements and calculations for the patient report. You can also select individual measurements within the protocol and perform them, as you need to.

Distance Measurements

2D Distance

Pressing the **DISTANCE** control initiates a distance measurement. You use the trackball to locate the measurement cursors on the image, and press the **SELECT** control to set the cursor and alternate control between the two cursors. Display of dots between the cursors can be set in the **Display** setups (**Dotted Line On/Off**). The dotted line connects the two cursors, and the distance between the two cursors is displayed and continually updated. As many as six consecutive measurements can be displayed in this way.

M-Mode Distance

During M-mode, when **DISTANCE** is first selected, one cursor is displayed on the 2D image. The distance of this cursor from the skinline is updated as you move the trackball.

At this point, you must freeze the M-mode display to perform an M-mode distance measurement. You must use the trackball to move the cursor onto the M-mode display. On the M-mode display, a dashed vertical line appears with a distance measurement cursor.

Once the first cursor is located and set, using the **SELECT** control, the dashed line disappears, and a second cursor is displayed. The cursors may be located along the same M-mode line, or you can press **DISTANCE** to display another dashed line, along which you can make another distance measurement. Distance between the cursors is continuously updated when the cursors are being moved. Distance or depth is measured between the two distance cursors. A total of seven cursors can be set along the same line, allowing six measurements.

Doppler Distance

The Doppler distance measurement is initiated with the **DISTANCE** control. If you press the **DISTANCE** control while the Doppler display is scrolling, a horizontal line cursor appears along the baseline. You will be able to identify the velocity or frequency along the Doppler scale by using the trackball to move the horizontal line cursor. You must press the **FREEZE** control to display a distance cursor with which you can measure the Doppler waveform.

Pressing the **SELECT** control displays a second cursor, which you locate with the trackball, and the measurement values are displayed in the Doppler results. Exactly which values are displayed depends upon your **Measurements** setups. If they are set in the **Measurements** setups, then the resistive index, systole/diastole ratio, and pressure gradient will be displayed. When you move the trackball these values will be updated. To display additional distance cursors, press **DISTANCE**; two pairs of distance cursors can be displayed.

Area Measurements

AREA

The **AREA** control provides measurement tools for circumference measurements from which the area is calculated for 2D. In Doppler imaging, the **AREA** control is used for velocity time integral or spectral area measurements. Press **AREA** to activate the first measurement cursor, using the default trace method. If you want to use a different trace method, then press **AREA** again to cycle through the available trace methods. You can change the area measurement method to one of the following three methods: continuous trace, ellipse, or trace by points (ellipse is not used in Doppler imaging). You can also determine the default method by selecting that method in the Measurements setups.

You can use **DEL MEAS** to erase the last segment of tracing made during the continuous trace or trace by points types of measurements. There is a limit to the length of line that can be erased with this control. When the limit is reached, pressing **DEL MEAS** will no longer erase the line.

The **2D Area Method** and the **Doppler Area Method** setups are available in the **Measurements** setups.

Continuous Trace

The continuous trace method allows you to trace the object of interest using the trackball. As you move the cursor with the trackball, the shape is continuously traced on the display. The area and circumference measurement values are displayed as results for 2D. Continuous trace can be used on 2D or Doppler displays. The results display for a Doppler area measurement depends upon the parameters selected in the Doppler Results Display in the **Measurement** setups.

Trace by Points

The trace by points method is similar to continuous trace, except it is an incremental method. The trackball is used to move the cursor to the perimeter of the shape to be measured. The **SELECT** control is used to fix the incremental positions of the cursor. The **AREA** button is used to close the trace. The area and circumference calculations are displayed as results in 2D. The results display for a Doppler area measurement depends upon the parameters selected in the Doppler Results Display in the **Measurement** setups.

Ellipse

The ellipse method allows you to display an ellipse and then vary the axes to measure objects on the 2D display. With the trackball, you establish the initial cursor position, press **SELECT**, then vary the axes of the ellipse that is displayed. You can adjust your measurement by selecting the cursors or axis with the **SELECT** control. The long and short axes, and the area and circumference calculations are displayed as results.

Calibration

WARNINGS

- 3D is considered qualitative in nature. Quantitative measurements must not be made from 3D images.
- Do not calibrate a VCR or DiskLink 3D image.
- Do not carry forward previously-obtained 2D calibration information to a 3D VCR or stored DiskLink image.

Calibration consists of providing the system certain image characteristics for recorded images. The recordings from a VCR, the images stored using the Image Management options, and review images captured using the Digital Video Streaming (DVS) option must be calibrated before they can be measured.

Once you have selected the type of image (2D, M-Mode, or Doppler) on the **Select Display** (which automatically appears when you attempt to measure a recorded or stored image), the system displays a list from which you select the appropriate characteristics (Figure 6–1). The values you select are the largest values in the lists that fit within the displayed depth, velocity, frequency, or time scale. Such selections will provide the most accurate calibration, smaller values will work, but they will not provide the accuracy that the largest value will provide. For example: a 80 cm/sec displayed velocity would be calibrated at 60 cm/sec calibration value.

The system displays a prompt and cursors. You position the cursors along the display scales. In this example, for the velocity calibration, you use the trackball and the **SELECT** control to position the cursors 60 cm/sec apart (the first cursor is always positioned on the Doppler baseline). After the calibration, you use the appropriate measurement tool to perform your measurement.

The calibration you perform persists until you change the calibration values or until you enter new patient data. For subsequent measurements, you can accept the current calibration, or you can calibrate the image. You can tell if a new calibration is necessary by looking at the calibration trace. If your depth or time scale trace from a previous calibration does not correspond to the scaling on the image you intend to measure, then a new calibration is needed.

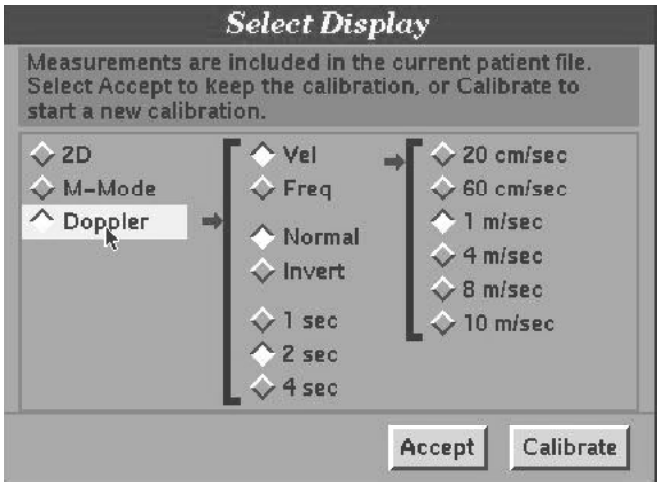


Figure 6–1. Doppler Display Calibration

Time/Slope

Once you freeze the Doppler or M-mode display, you can perform a time and slope measurement. The **Time/Slope** measurement tool on the Meas Tools menu provides this capability.

Selecting **Time/Slope**, displays a vertical time cursor and a distance cursor that slides along the vertical time cursor. Once the first vertical time cursor is located using the trackball, and set, using the **SELECT** control, a second vertical time cursor is displayed.

The second vertical time cursor also has a sliding distance cursor which is connected to the previously set distance cursor by a line. The line between the two cursors establishes the slope, and the distance along the time scale between the two distance cursors establishes the time. The cursors can be alternately selected by pressing the **SELECT** control.

For the M-mode display, the time in milliseconds or seconds, the vertical distance in centimeters, and the slope in centimeters/second are continuously calculated and updated in the results (Figure 6–2). For the Doppler display, the time between the cursor and the vertical line as measured along the time scale, the velocity or frequency between the cursors as measured along the vertical scale, and the rate of change or slope (acceleration or deceleration) between the two cursors are continuously calculated and updated in the results.

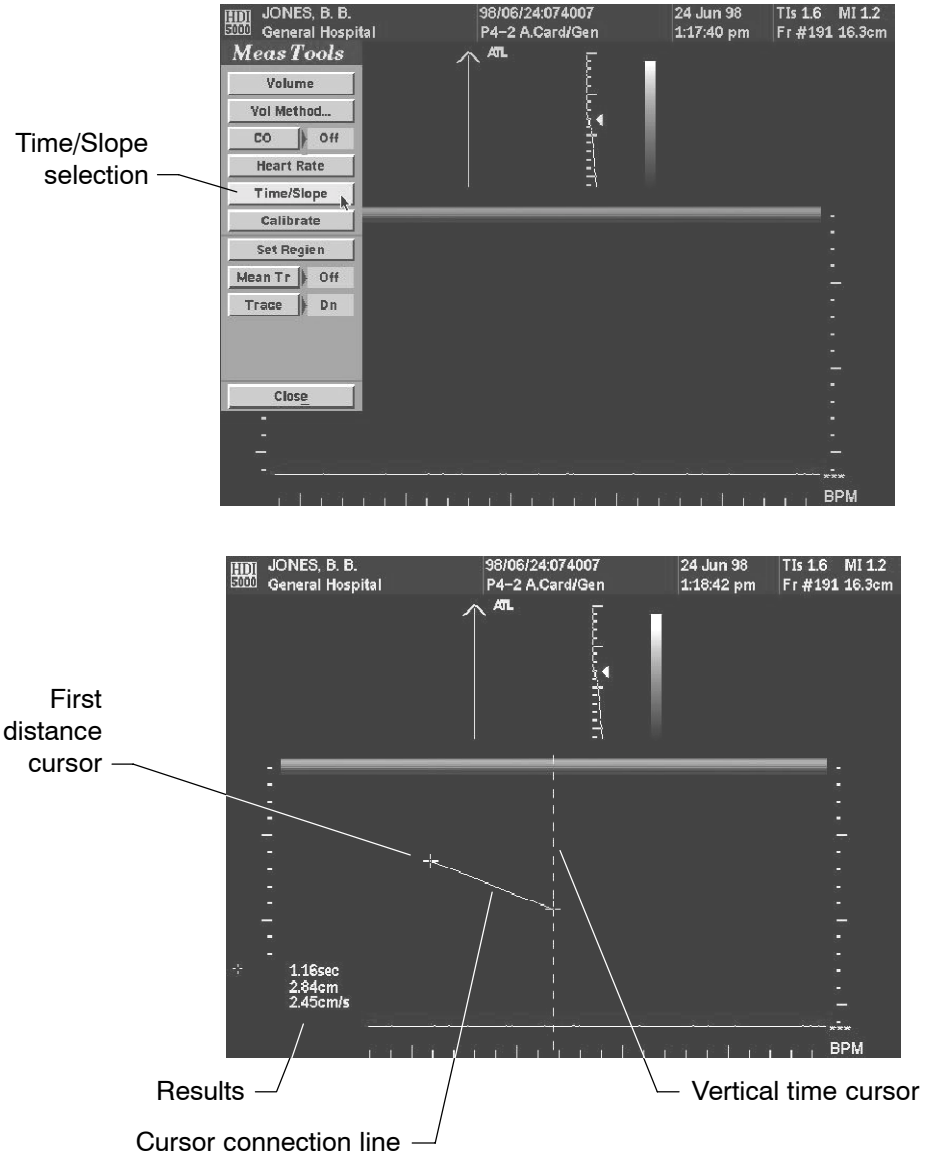


Figure 6–2. M-Mode Time/Slope Measurement

Heart Rate

The heart rate measurement tool provides measurement cursors that you can position on the scrolling display with the trackball. From your placement of these measurement cursors the system calculates the value of the heart rate, and displays the value in beats per minute (bpm) in the results in the lower left corner of the video display. The heart rate measurement tool can be used on the M-mode, Doppler, or the ECG display.

Volume

There are three methods by which volume can be calculated: 3 Distances, 1 Distance, and 1 Distance and 1 Ellipse. You can select the use of one of these methods using the **Volume Method** selection on the **Meas Tools** menu.

The calculation by the system will use the three distances for D_1, D_2, and D_3 in the volume equation.

The calculation by the system will assume equal D_1, D_2, and D_3 in the volume equation with the one distance method.

Using the one distance and one ellipse method, the long axis and the short axis of the ellipse are identified by the system, and these two values are substituted into the volume equation for two of the distances, say D_1 and D_2. The third distance, D_3, is taken from your distance measurement.

Volume

$$Volume = \frac{4}{3}\pi \cdot \frac{D_1}{2} \cdot \frac{D_2}{2} \cdot \frac{D_3}{2}$$

where: D = distance

- Beyer, W.H., “Standard Mathematical Tables, 28th Edition.” CRC Press, Boca Raton, Florida, 1987, page 131.

Volume Flow Measurement

The volume flow measurement has been used predominantly in the extremities for vascular applications. General imaging applications have measured flow in the portal vein.

The volume flow measurement requires that you obtain a longitudinal view of the vasculature and measure its diameter. A spectral waveform derived from the same area is also required. The sample volume should be centered in and completely insonate the vessel. The resulting spectral waveform is then traced using an automatic trace method that estimates the time-averaged mean, which is used to calculate volume flow. The accuracy for this method of volume flow calculation is ±30%.

From the **ADV MEAS** control, the **Trace** selection on the **Meas Tools** menu allows you to select the spectral data, above the baseline, below the baseline, or the full range—above and below the baseline—from which the volume flow trace and resulting calculation will be made. The system will display the 2D area of the vessel, the spectral time-averaged mean velocity, and the volume flow.

The following factors should be considered when obtaining volume flow measurements:

- When selecting appropriate views and identifying specific measurement points on images, follow the investigator–specific medical practice, or if none is cited in the source, follow current medical practice.

WARNINGS

- The spectral data used for the volume flow calculation must NOT be aliased spectral data. Incorrect estimates will result from aliased spectral data.
- The spectral data that you select for the volume flow calculation must cover a number of complete heart cycles. Incomplete heart cycles cannot be distinguished in the calculation, and if selected will result in invalid, inconsistent, or no calculation.

- The spectral data that you select for the volume flow calculation must have a consistent gain and an amplitude level that exceeds the background noise level.
- All calculations are carried out on non-graymapped spectral data. This method ensures an accurate calculation, but may result in a measurement trace that does not line up exactly with the graymapped spectral display.
- You may perform a volume flow measurement using duplex or simultaneous update, color or gray-scale images.
- Obtaining volume flow calculations in simultaneous mode will reduce the accuracy of the calculation.

- The accuracy of the mean velocity (Vmean) and volume flow calculations is largely user-dependent. Factors identified in the literature that affect the accuracy of these calculations are as follows: estimating the mean velocity by insonating the entire vessel with one sample volume; measuring the 2D area using the diameter measurement method; precision of cursor placement; accuracy of determining angle correction.
- Because there is no 2D image display when you use a static pencil probe, it is not recommended that you attempt a volume flow measurement from spectral data obtained using a static probe.
- Volume flow measurements of vessels that are less than 2 mm in diameter are not recommended.
- When making volume flow measurements, make sure that the sample volume is centered on and completely insonates the vessel.
- When making volume flow measurements, make sure that the angle correction cursor is parallel to the direction of flow.

The technical difficulties in performing volume flow measurements and calculations are outlined in the following references:

Burns, P.N. *Clinical Applications of Doppler Ultrasound*, Raven Press, N. Y., 111–118, 1988).

Eik-Nes, S.H., Marsal, K., and Kristoffersen, K. “Methodology and Basic Problems Related to Blood Flow Studies in the Human Fetus.” *Ultrasound in Medicine and Biology*, 10:329-337, 1984.

Gill, R. W. “Measurement of Blood Flow by Ultrasound: Accuracy and Sources of Error.” *Ultrasound in Medicine and Biology,* 4:625-641, 1985.

Cardiac Output (CO)

The cardiac output measurement tool calculates cardiac output and stroke volume from a 2D diameter bar measurement, a Doppler velocity time integral (VTI) measurement, and a heart rate measurement. The heart rate is calculated from the same region as the VTI. The peak trace is enabled during the cardiac output measurement.

Once the cardiac output measurement tool is initiated, it remains active until the measurement is completed or the measurements are deleted from the screen. The measurement values are not saved when the measurement is ended. The diameter bar distance measurement cannot be edited. The accuracy for this method of cardiac output calculation is ±30%.

High Q Automatic Doppler Measurement Tools

The High Q automatic Doppler measurement tools consist of the **Set Region**, **Mean Trace**, and **Trace** selections on the **Meas Tools** menu, and the **High Q** control on the control panel.

Set Region

Set Region displays measurement cursors with which you can specify a specific region of the Doppler display for High Q automatic Doppler display calculations (Figure 6–3).

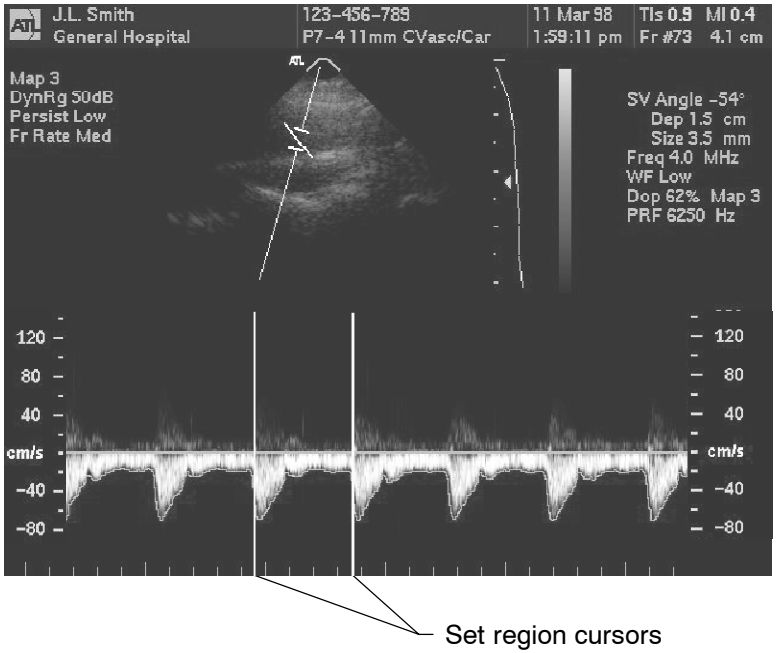


Figure 6–3. Set Region Tool

Mean Trace

High Q **Mean Tr (Tr**ace) allows you to turn on or off the display of the mean Doppler trace function. The instantaneous mean is calculated and is displayed as an overlay on the Doppler waveform (Figure 6–4). In cardiology clinical options, this tool and calculation are unavailable.

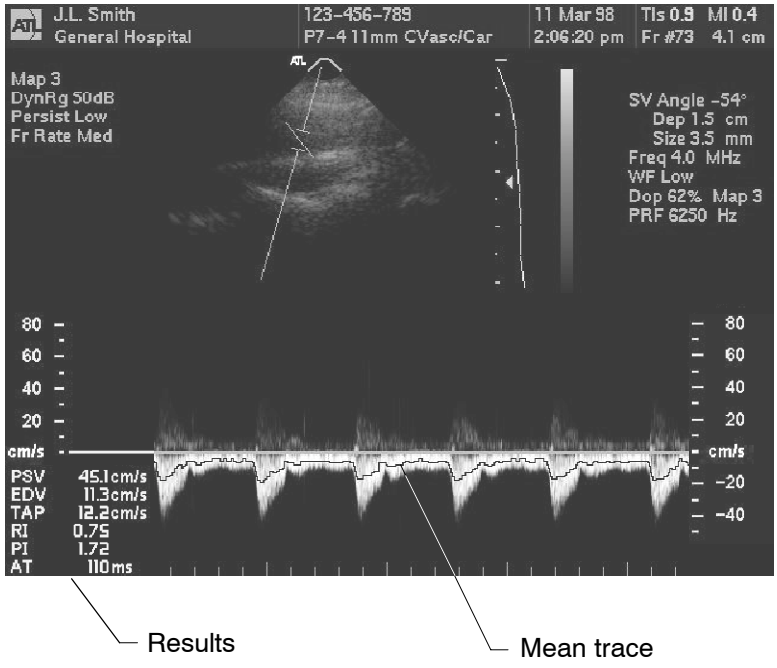


Figure 6–4. Mean Trace

Trace

High Q **Trace** allows you to choose which part of the spectral trace is used to calculate the High Q values (Figure 6–5): above the baseline (**Up**), below the baseline (**Dn**), or from both above and below the baseline (**All**). In cardiology clinical options, All is not available as a selection.

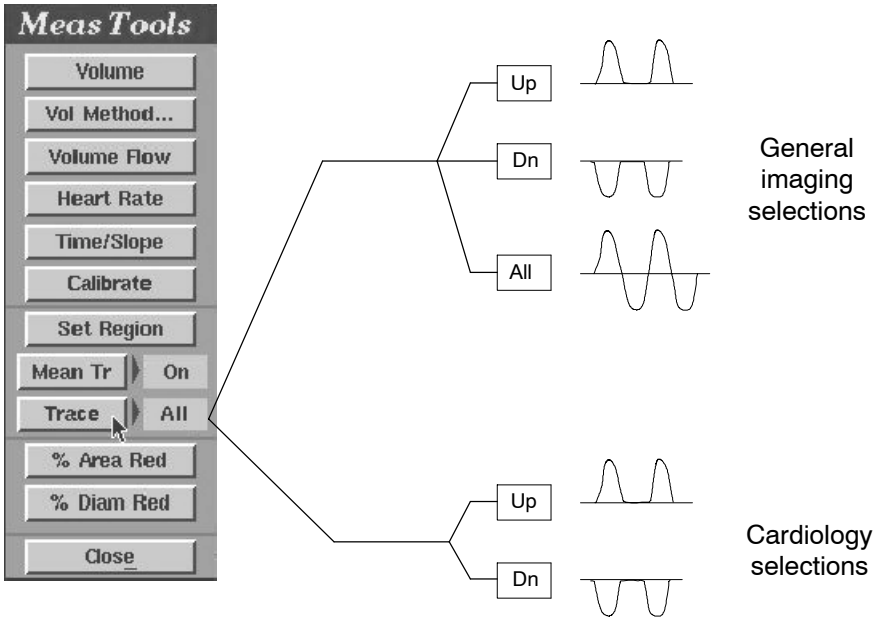


Figure 6–5. Trace

High Q Control

High Q Automatic Doppler measurement initiates the automatic calculation and display of the specific values you select associated with the Doppler waveform. The number of heart cycles selected in the **Measurements** setups for High Q automatic measurement and the **Doppler Results Display** setup values establish the parameters with which the High Q automatic measurement works and the values that are displayed. The **High Q** control also turns on the peak trace display (Figure 6–6).

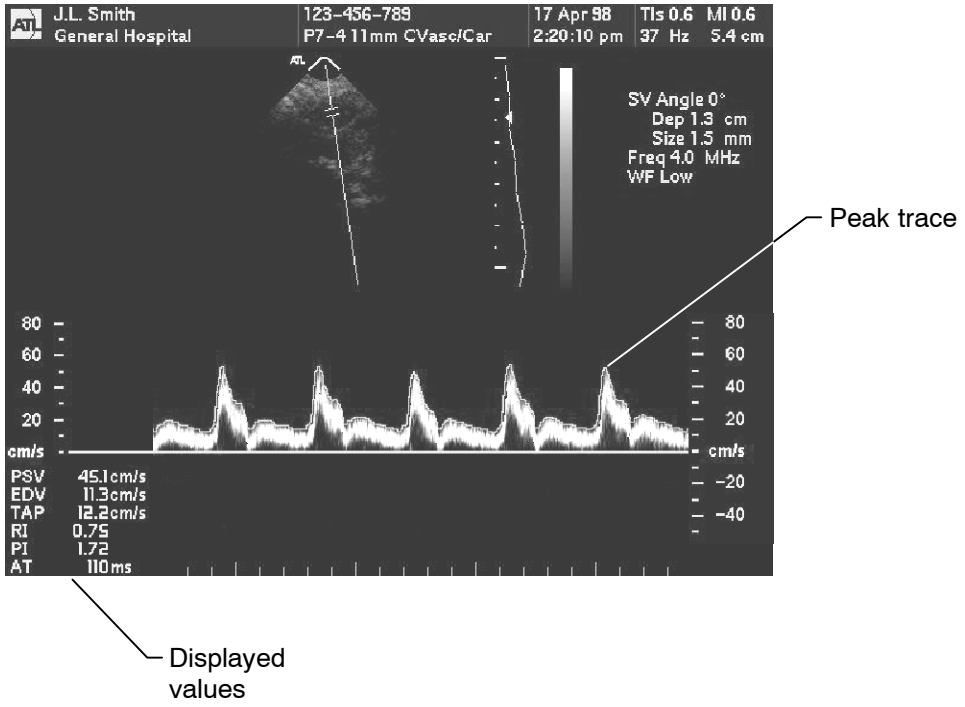


Figure 6–6. High Q Control: Peak Trace

High Q Automatic Doppler Display

How the High Q automatic Doppler display works depends upon your clinical option. Cardiology clinical options differ from the other clinical options when it comes to the High Q automatic Doppler display. For example, the capability to display frequency units in cardiology clinical options does not exist in the High Q automatic Doppler display. For those situations in which the use of High Q automatic Doppler display differs for the cardiology or non-cardiology clinical options, these differences will be noted in the following explanation of the High Q automatic Doppler display.

Non-Cardiology High Q Automatic Doppler Display

High Q automatic Doppler display results include measurement values for peak velocity/frequency traces and mean velocity traces in both real-time and freeze for non-cardiology clinical options. The peak trace can be turned on or off in real-time Doppler acquisition or in freeze, using the **HIGH Q** control. The mean trace can be turned on or off from the **Meas Tools** menu.

Up to six of the following real-time calculations can be selected from the **Measurements** setups and displayed on the Doppler display for non-cardiology clinical options:

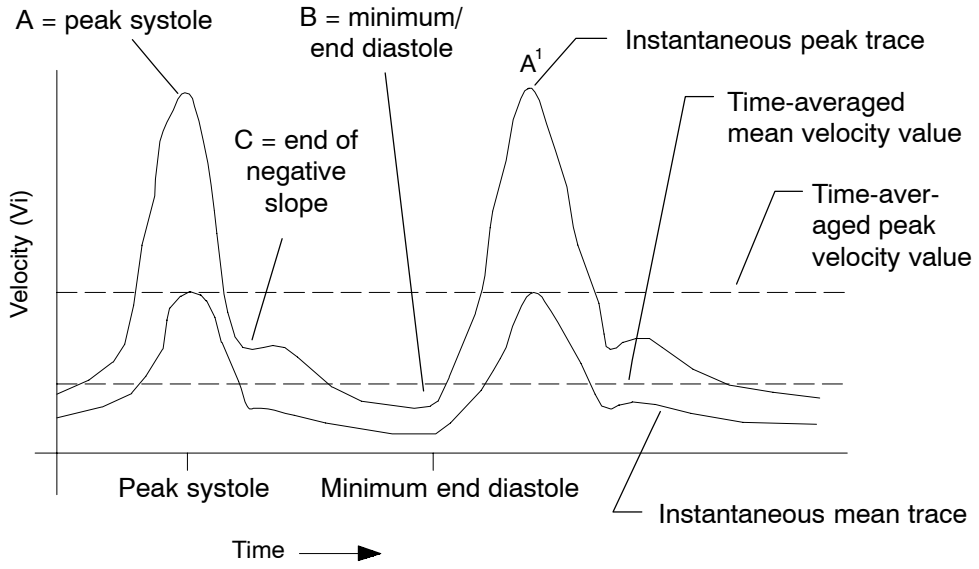
- Acceleration time
- Deceleration time
- Time-averaged mean velocity
- Peak systolic velocity or frequency
- Minimum diastolic velocity or frequency
- End diastolic velocity or frequency
- Time-averaged peak velocity or frequency
- Resistive index
- Pulsatility index
- Systole/Diastole ratio
- Velocity time integral (VTI)
- Pressure gradient
- Heart rate

The Doppler waveform shown in Figure 6–7 shows the various characteristics and calculations that can be displayed for non-cardiology clinical options.

For non-cardiology clinical options:

- The mean trace can be turned on or off in the **Meas Tools** menu, which is available from the **ADV MEAS** control.

- Flow above the baseline, below the baseline, or both above and below the baseline can be considered in the calculations. The flow direction can only be changed in real-time with the **Trace** selection on the **Meas Tools** menu, which is available from the **ADV MEAS** control. You cannot change flow direction while the system is in freeze.
- The **Set Region** selection on the **Meas Tools** menu allows you to use the trackball and the **SELECT** control to define a sequence of heart cycles from which the Doppler results will be calculated and displayed. The calculation is based on the average of the complete heart cycles between the **Set Region** cursors.



Resistive index = $\frac{(A-B)}{A}$

Pulsatility index = $\frac{(A-B)}{\text{Time-Avg Pk}}$

Velocity Time Integral = Sum of Vi ($\triangle$ t)

Pressure Gradient = $4A^2$

Acceleration time = $A^1_t - B_t$

Deceleration time = $A_t - C_t$

S/D = $|A / B|$

Figure 6–7. High Q Calculations of the Doppler Waveform: Non-Cardiology

Cardiology High Q Automatic Doppler Display

High Q automatic Doppler display results for cardiology applications include the following:

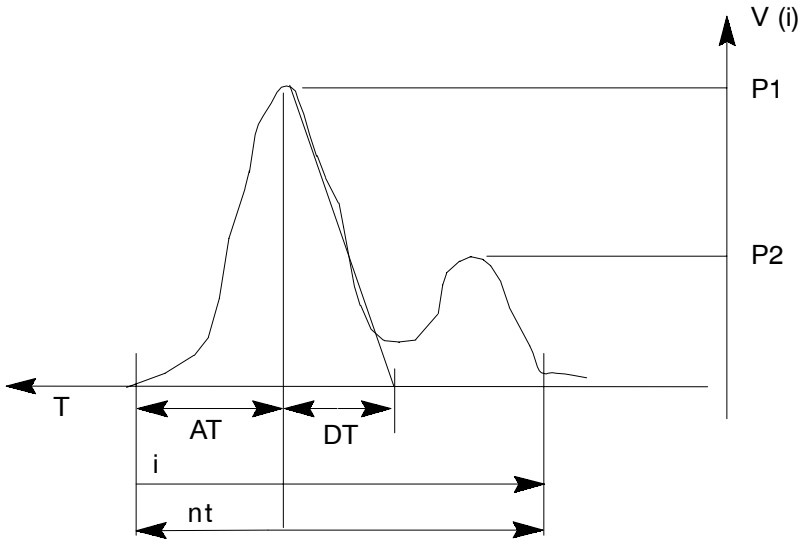
- Peak velocity
- Peak gradient
- VTI
- Mean velocity
- Mean gradient

Peak velocity and peak gradient, if selected in the **Measurements** setups, can be updated in real-time. VTI, mean velocity, and mean gradient can be calculated and displayed, along with peak velocity and peak gradient, when the display is frozen.

The Doppler waveform shown in Figure 6–8 shows the various characteristics and calculations that can be displayed for cardiology clinical options.

For cardiology clinical options:

- The **Trace** selection alternatives are above or below the baseline. For cardiology clinical options, **All** is unavailable as a choice for the **Trace** selection on the **Meas Tools** menu.
- The heart cycle is determined by the detection of the R-wave in the QRS complex of the ECG waveform. Calculations for the High Q automatic Doppler display cannot occur if the R-wave trigger signal is not present. The ECG waveform is a necessary component of the Doppler echocardiography study.
- Before pressing the **FREEZE** control, the peak trace and the automatic Doppler results for peak velocity and peak gradient are updated in real-time. When you press the **FREEZE** control, the peak trace, the automatic Doppler results, and two vertical cursors appear on the Doppler display. The High Q automatic Doppler results display values pertain to the region defined by the vertical cursors. The cursors can be moved with the trackball. The **SELECT** control toggles between the cursors and completes the calculations. The calculations in the Doppler results pertain to the Doppler information between the vertical cursors.



Peak gradient $= 4V^2$

Mean gradient $= \frac{\text{PTI}}{\text{Duration of Flow}}$

$\text{PTI} = \text{Sum of Pi} \cdot \Delta t$

Pi is pressure (calculated to be 4 Vi^2) during each nt of the velocity spectral area. Pressure units are mmHg and nt is in seconds.

Time-averaged peak velocity or mean velocity $= \frac{\text{VTI}}{\text{Duration of Flow}}$

$\text{VTI} = \text{Sum of Vi} \cdot \Delta t$

Vi is the velocity during each Dt of the spectral area to be measured. Velocity (Vi) units are meters per second and Dt is in seconds.

Figure 6–8. High Q Calculations of the Doppler Waveform: Cardiology

High Q Automatic Doppler Considerations

Consider the following when using the High Q Automatic Doppler display:

- The High Q display does not compensate for aliased Doppler data. Do not select aliased Doppler data for analysis.
- Doppler gain should be set for optimal signal to noise conditions. Varying gain levels will affect the accuracy of the estimates and insufficient signal amplitude will cause the trace to drop to zero or hold over a previous value. New heart cycles with consistent gain and signal level should be acquired and used for the analysis.
- Accurate mean velocity estimates are made by careful positioning of the sample volume. A large sample volume should be selected and positioned to completely insonate the vessel in the 2D image plane. The sample volume must also be centered on the vessel. The accuracy of the velocity estimates will be reduced by errors due to angle correction. To obtain the most accurate estimates, angle correction must be applied. The accuracy decreases as the flow angle increases.
- A minimum of one heart cycle is required to adapt to new signal to noise conditions. During this adaptation period, a less than optimal trace will be displayed. The more heart cycles that are included in the averages, the more accurate the calculation. Both heart rate and scroll rate limit this calculation. The High Q Measurements setup, **Update every j heart cycles**, allows you to set the number of heart cycles that will be used to calculate the Doppler results display. Only one heart cycle is used to calculate cardiology High Q Automatic Doppler results. The automatic High Q calculations do not calculate the average of multiple heart cycles.
- For maximum accuracy, analysis should be performed on optimized spectral displays based on a correctly selected PRF. The Doppler display resulting from simultaneous acquisition is less accurate and should not be used for analysis.
- High Q automatic Doppler display results should not be used on Doppler displays that exhibit heart rates above 130 beats per minute.

High Q Calculation Accuracy

Accuracy estimates for the High Q calculations are identical to those provided for Doppler. These accuracy estimates are based entirely on the systematic errors inherent in making velocity measurements from the spectral display. These estimates do not take into account exam-dependent factors such as tissue attenuation, spectral broadening, or scanhead placement.

Optional Measurement Tools

There are four optional measurement tools available with the system: two pediatric measurement tools and two vascular measurement tools.

Pediatric Measurement Tools

The two pediatric measurement tools that are available with the system are the Hip Angle and d:D Ratio measurement tools. They provide you a sequence of steps that result in two hip angle values and a ratio of coverage of the femoral head. With the information contained in the sources listed in this section, you can use these values to evaluate infant growth and development.

Hip Angle

The development of the acetabular roof and the subluxation of the femoral head can be quantified by angular measurements (Figure 6–9). The baseline connects the osseous acetabular convexity to the point where the joint capsule and the perichondrium unite with the ilium. The inclination line connects the osseous acetabular convexity to the labrum acetabulare. The roof line connects the lower edge of the os ilium to the osseous acetabular convexity.

Angle A is defined by the roof line and the baseline. Angle A characterizes the formation of the osseous acetabular convexity. Angle B is defined by the inclination line and the baseline. Angle B is a measure of the formation and size of the cartilaginous convexity. Refer to the sources for more information about the hip angle measurement.

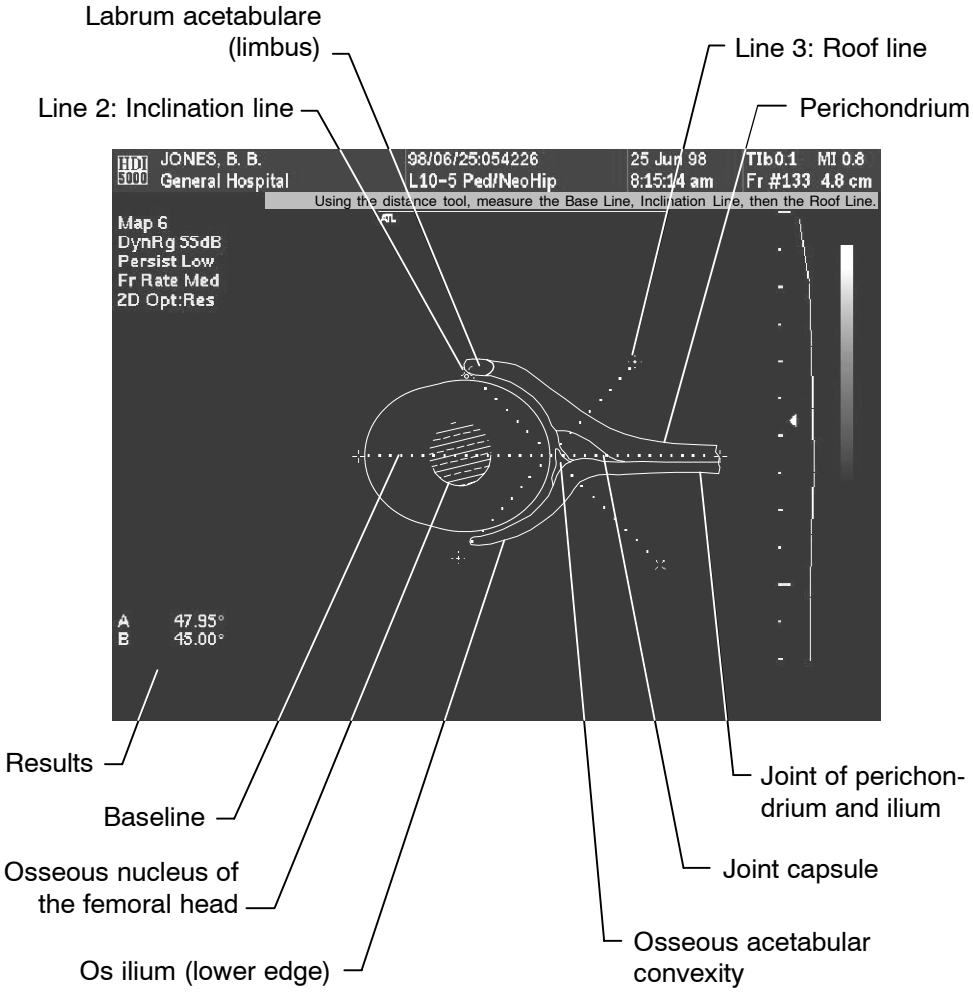


Figure 6–9. Hip Angle

d:D Ratio

Where the hip angle tool allows the classification of acetabular dysplasia by the determination of several angles defined by anatomic landmarks, the d:D ratio tool involves measuring the relative percentage of coverage of the femoral head by the bony acetabulum (Figure 6–10).

The coronal-flexion view—an image produced with the scanhead positioned on the lateral aspect of the flexed hip (90 degrees flexion and slight abduction) and the plane parallel to the long axis of the body—was used in the reference study.

The d:D ratio tool requires the circumference of the femoral head. The Baseline, or the ilium line, is then identified relative to the femoral head.

The distance between the medial point on the femoral head and the Baseline is represented by d. The distance between the medial point on the femoral head and the labrum acetabulareis represented by D. The ratio of d to D, multiplied by 100, indicates the percentage of coverage of the femoral head.

Sources

1. Graf, R. “Fundamentals of Sonographic Diagnosis of Infant Hip Dysplasia.” *Journal of Pediatric Orthopedics*, Vol. 4, No. 6: 735–740, 1984.
2. Morin, C., Harcke, H., MacEwen, G. “The Infant Hip: Real-Time US Assessment of Acetabular Development.” *Radiology* 177: 673–677, December 1985.

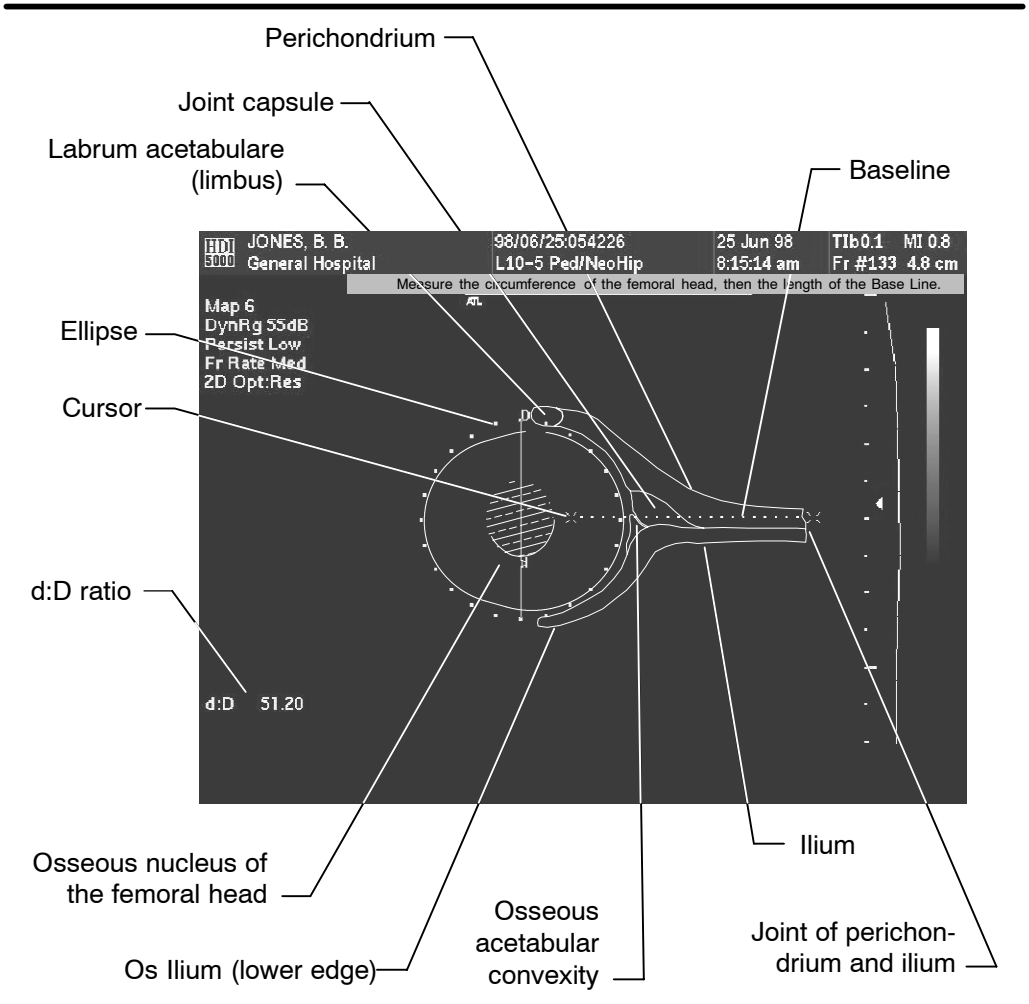


Figure 6–10. d:D Ratio

Vascular Measurement Tools

There are two vascular measurement tools available with the system: Percent Diameter Reduction and Percent Area Reduction.

Percent Diameter Reduction

The percent diameter reduction is derived from a 2D diameter measurement of the original or unreduced vessel and a 2D diameter measurement of the stenotic or reduced lumen diameter (Figure 6-11).

The protocol requires that you obtain a longitudinal 2D view of the vasculature, use one set of cursors to define the diameter of the unreduced portion of the lumen, and the other set to define the diameter of the reduced or stenotic portion. Once these values are entered into the system, the system displays the diameter measurements, and it calculates and displays the diameter reduction in the results.

The following reference is recommended:

Taylor K. J. W., Burns P. N., Breslau P. *Clinical Applications of Doppler Ultrasound*. Raven Press, N.Y., 130–136 (1988).

Equation for Percent Diameter Reduction

$$\%\ Diameter\ Reduction\ = (1 - \frac{d\ (cm)}{D\ (cm)}) \cdot 100$$

where: d = reduced diameter of the vessel in centimeters

D = original diameter of the vessel in centimeters

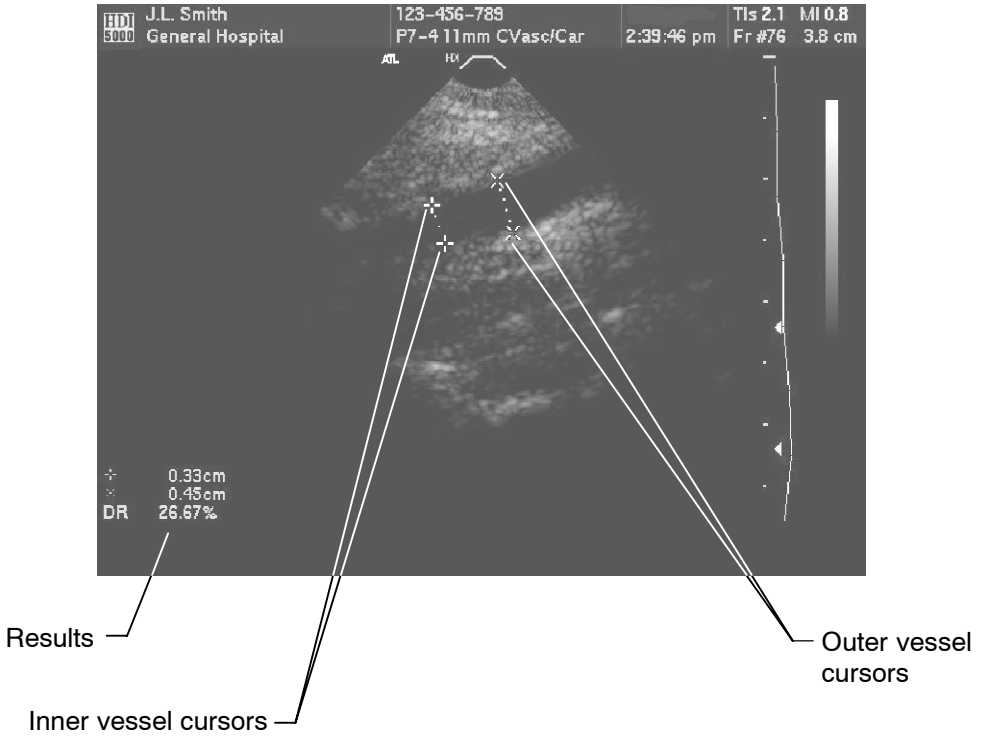


Figure 6–11. % Diameter Reduction

Percent Area Reduction

The percent area reduction is derived from 2D area measurements. It can be used for quantification of the lumen area. A cross-sectional outline of the original or unreduced vessel is obtained. This measurement is then compared to a tracing of the stenotic or reduced lumen (Figure 6-12). From these measurements, the system calculates the 2D areas and the percent of area reduction. In general, analysis of the Doppler spectral waveform allows better quantitation of the hemodynamic significance of lumen reduction than does the percent area reduction.

The protocol requires that you obtain a cross-sectional 2D view of the vasculature, use one set of cursors to define the circumference of the unreduced portion of the lumen, and the other set to define the circumference of the reduced or stenotic portion. Once these values are entered into the system, the system calculates the percent of area reduction and displays the maximum area, the minimum area, and the percent of area reduction in the results.

The following references are recommended:

Taylor K. J. W., Burns P. N., Breslau P. “Clinical Applications of Doppler Ultrasound,” Raven Press, N.Y., 1988, 130–136.

G. O. Roederer, M.D., Y.E. Langois, M.D., F.R.C.S., K.A. Jager, M.D., J.F. Primozich, B.S., K. W. Beach, Ph.D., M.D., D.J. Phillips, Ph.D., and D.E. Strandness, Jr., M.D. “The Natural History of Carotid Arterial Disease in Asymptomatic Patients with Cervical Bruits.” *STROKE* 15 (4): 605–613, 1984.

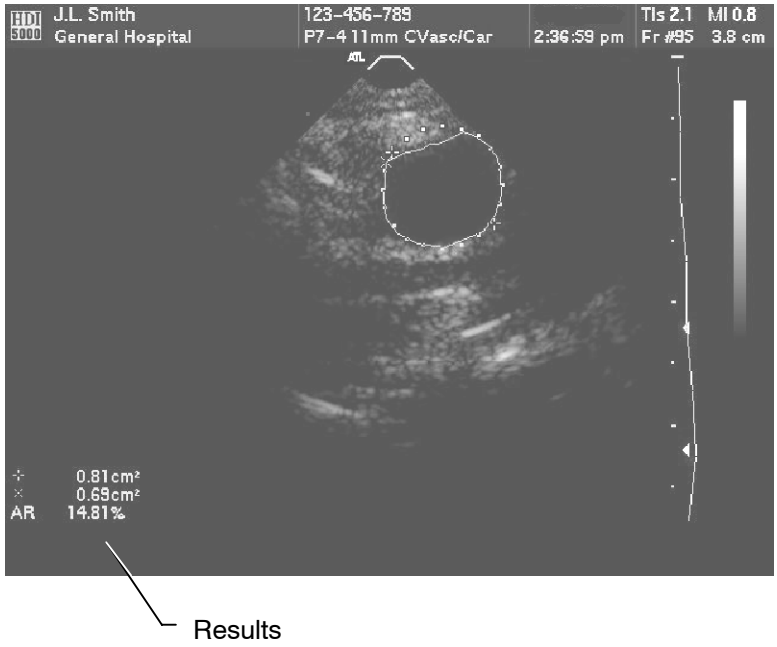


Figure 6–12. % Area Reduction

Equation for Percent Area Reduction

$$\%\ Area\ Reduction = \left(1 - \frac{a\ (cm^2)}{A\ (cm^2)}\right) \cdot 100$$

where: a = reduced area of the vessel in square centimeters

A = original area of the vessel in square centimeters

Rules for Measurements

- Measurements can be started, but they cannot be completed on a live image.
- High Q Automatic Doppler measurements are not allowed on VCR playback images.
- Changing the scaling of an image erases all measurements from the display.
- In scrolling displays, a black sweep bar indicates the separation between old and new data, and a gray transition bar indicates that certain acquisition parameters have been changed, interrupting acquisition. ATL recommends that you do not make measurements across either the black sweep bar or the gray transition bar.
- Inverting or flipping the image will abort the measurement, except for a live Doppler cursor that will invert with the Doppler waveform.
- The number of measurements displayed depends upon the measurement being performed.
- Selecting another measurement type in the middle of a measurement aborts the current measurement and starts the new measurement.
- Using the measurement tools to perform multiple measurements on different image views can result in measurements unrelated to the displayed image. If the relationship between a measurement and an image is in doubt, press the **DEL MEAS** control to end or delete the measurement tool. To determine the status of a measurement tool, check the prompt above the image; this prompt is not displayed on a hardcopy print.

Measurement Accuracy

Factors Affecting Measurement Accuracy

2D Imaging

- Resolution is proportional to the scanhead frequency.
- Penetration is inversely proportional to the scanhead frequency.
- Resolution is always best near the focal zone of the scanhead where the ultrasound beam is narrowest.
- The user sets the focal point depth.
- Measurements are most accurate near the focal depth and less accurate away from the focal point as the acoustic beam widens.

Doppler Modes

- Lower frequency scanheads are capable of measuring higher velocity flows.
- Sample volume size is limited laterally by the acoustic beam.
- Penetration is best with low frequency scanheads.

Color Flow Modes

- There is no measurement protocol designed specifically for Color or Power imaging. The accuracy of measurements made in Color are subject to the same limitations as a similar type of measurement made on a gray-scale image.
- Do not use Color values for precise flow velocity quantification in any application.
- Color flow values are estimates of the mean velocity, and will not necessarily represent peak velocities.
- The method of choice for quantifying flow for any application is spectral analysis using pulsed or continuous-wave Doppler.

Display Size

- The precision with which a cursor can be placed in an image can be improved by making sure that the area of interest fills as much of the screen as possible.
- In 2D imaging, distance and area measurements are improved by minimizing the display depth and using the zoom function where possible.
- In M-mode and Doppler, time measurements are improved by using the highest possible sweep speed.
- In Doppler, velocity measurement accuracy is improved by using the smallest possible vertical scale setting.

Cursor Placement

- When making a measurement, accurate placement of the cursor is essential.
- To improve cursor placement precision:
  - Adjust the display for maximum sharpness.
  - Use leading (closest to the scanhead) edges or borders for start and stop points.
  - Maintain a consistent scanhead orientation for each type of measurement.

Sources of Measurement Errors

Speed of Sound

Ultrasound imaging and Doppler algorithms assume that the speed of sound is constant at 1,540 meters per second. However:

- The speed of sound varies for different tissue types.
- In cardiovascular applications where soft tissues, blood, and fatty layers are all involved, the error is random, but is typically on the order of two to five percent.
- Ensure that your tissue-equivalent phantom meets the following specification: speed of sound = 1,540 m/sec. If your tissue-equivalent phantom does not meet this specification, linear measurements derived using your tissue-equivalent phantom will be inaccurate.

Doppler Alignment

Doppler velocity measurements are most accurate when the acoustic beam is aligned parallel with blood flow.

- Deviations from the parallel alignment of up to 20 degrees for Doppler angles result in measurement errors of 6% or less.
- For larger alignment errors (Doppler angles exceeding 20 degrees), the measurement accuracy falls off rapidly, and use of angle correction is recommended (vascular applications only).
- The Doppler angle correction appears in the patient report with the Doppler measurements.

Aliasing

Pulsed Doppler uses signal sampling techniques to compute a frequency (or velocity) spectrum.

- A theoretical limit exists for the maximum measurable velocity.
- When measuring high velocities, the sampling rate, which is determined largely by the sample volume depth, may be insufficient; and velocity wraparound (aliasing) may occur.
- A possible result could be that normal, high-velocity, laminar flows would be perceived as turbulence.
- Aliasing can be minimized, in some cases, by:
  - Moving the baseline
  - Increasing the velocity scale
  - Using a lower frequency scanhead.
- In continuous-wave mode, aliasing is virtually eliminated.

Velocity Measurement Resolution in Doppler

In computing velocity spectra, the velocity field (the area where flow exists) is assumed to be stationary. However:

- In cardiovascular applications, velocity fields do not remain constant, owing to the pumping action of the heart.
- The dynamics of blood flow places a practical upper limit on velocity resolution and spectral edge sharpness.
- The acoustic beam width determines the extent to which velocities can be differentiated in composite blood flow patterns.

Formulas

Some formulas used in clinical applications are based on assumptions or approximations.

EXAMPLES: Volume formulas may assume a specific three-dimensional shape. Pressure formulas use a simplified version of equations from fluid mechanics.

All formulas used in ATL ultrasound systems have as their basis extensive clinical references from medical literature. These references, along with the actual formulas and the appropriate assumptions and approximations are described in the pertinent sections of this manual.

Measurement Accuracy Tables

The measurements provided by the system do not define a specific physiological or anatomic parameter. Rather, what is provided is a measurement of a physical property such as distance or velocity for evaluation by the clinician. Measurement and analysis performance includes the accuracy of the measurements and the accuracy of algorithms used to analyze the measurements. The accuracy values require that you place the calipers over one pixel. The values do not include acoustic anomalies of the body.

For each of the measurements available on the system, the measurement accuracy and range over which that accuracy is valid is shown in the following tables.

The RMI 413A phantom (.7 dB/cm/MHz) is used for all 2D and M-mode measurement accuracy tests.

Table 6–1. 2D Measurement Accuracy and Range

Measurement Type	Range	Accuracy	Notes
2D Distance:			
Axial Distance	.01 – 25 cm	± 1% or 1 mm	
Lateral Distance	.01 – 35 cm	± 2% or 2 mm	
Diagonal Distance	.01 – 25 cm	± 2% or 2 mm	

Table 6–2. M-mode Measurement Accuracy and Range

Measurement Type	Range	Accuracy	Notes
Depth	25 cm	± 1% or 1 mm	
Time	.01 – 11.3 sec	± 2% of time measurement	
Slope	.01 – 999.99 cm/sec	± .01 cm/sec	

Table 6–3. Doppler Measurement Accuracy and Range

Measurement Type	Range(2)	Accuracy	Notes
Velocity measurement	Pulsed: 0.1 cm/s – 8.8 m/s CW: 0.1 cm/s – 19.3 m/s	±1% or 1/2 pixel	Electronically injected test signal
Frequency measurement	Pulsed: 10 Hz – 22.727 kHz CW: 10 Hz – 50.0 kHz	±1% or 1/2 pixel	Electronically injected test signal
Time	10 ms – 9.44 s	2 columns	

Table 6–4. Infant Measurement Hip Angle Accuracy and Range

Measurement Type	Accuracy	Notes
Hip Angle A	± 3 degrees	
Hip Angle B	± 3 degrees	
d:D Ratio	± 3%	

Calculations

Calculations result from the measurements that you make with the measurement tools. Some calculations are directly shown on the display, others are done by the system and appear in a measurement protocol, still others appear only in the patient report. This section describes the controls, protocols, and reports that make up Calculations (CALCS).

CALCS Controls

The calculations controls are **FREEZE**, **DISTANCE**, **AREA**, **SELECT**, **DEL MEAS**, **ADV MEAS**, and the trackball. Before attempting to use CALCS, you should understand how to use these controls. It is especially important to understand that a measurement must be completed on a frozen image before the measurement value can be stored into the patient report using a measurement protocol. When you press the **CALCS** control, a CALCS menu appears on the left side of the video display. The clinical option name appears at the top of the menu. The CALCS menu includes a list of protocols.

Measurement Protocols

Measurement protocols are available based on the clinical option and Tissue Specific preset you select when you select a scanhead.

The protocol is a list of measurement labels, usually acronyms or abbreviations (Figure 7–1). It includes areas in which you enter measurement values. Some protocols require certain measurements, others require a specific sequence be observed when performing and entering the measurements, and still other protocols simply provide a storage location for several different types of measurements related to a specified structure, tissue, or vessel.

Storing a measurement into a protocol automatically places the measurement value into the patient report under the measurement name. Storing certain measurement values may also result in the automatic calculation of a ratio or other value: for example, the ICA/CCA ratio is calculated from the peak velocity values entered into the protocol for the common carotid artery and the internal carotid artery.

The number of measurement values that can be stored for specific measurements in a protocol varies from three for an OB measurement to ten for a cardiology Doppler measurement.

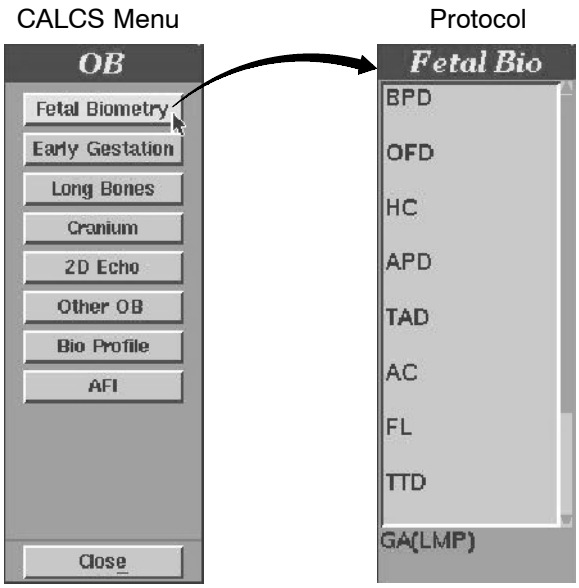


Figure 7–1. Storing Measurements in a Protocol (OB Example)

Storing Measurements

To store a measurement into the patient report, a protocol must be open and active. Open and active means that the protocol is displayed and that measurement values can be entered into it (Figure 7–1). Storing a measurement automatically enters the measurement value into the patient report.

Things to remember when making and storing measurements:

- A measurement must be entered into the protocol immediately upon completion or before another measurement is performed.
- Measurements are always presented in the patient report in chronological order.
- When you open a patient report, the patient report will open at the page in the patient report that corresponds to the currently active protocol.
- Only one value in a set of values is displayed in the protocol. All of the values are shown in the patient report: three values for most measurements, four values for what is termed as custom, user-defined, or new measurements, and ten values for cardiology Doppler measurements.
- When you delete a measurement with the **DEL MEAS** control, the next most recent measurement is displayed in place of the one deleted.

- If the maximum number of measurements has been stored, storing another measurement under the same measurement name deletes the oldest stored measurement.
- In the **Echo Doppler** protocol, the calculations derived from an area trace of the Doppler waveform are based on the assumption that the area trace covers a complete heart cycle (between the onset of systoles). If the area trace covers the complete heart cycle, then the calculations using the **AREA** control and the **High Q** Control will be the same. This method of tracing is appropriate if the system defaults are used for the **Measurements** setups: **Peak Systolic Vel/Freq**, **End Diastolic Vel/Freq**, **Resistive Index**, and **Pulsatility Index**. If you change the system defaults, and you intend to measure only a portion of a heart cycle, then use the **AREA** control, and not the **High Q** control. Additionally, the Doppler parameters that require a complete heart cycle for an accurate measurement—**Pulsatility Index** and **Resistive Index**—should be turned off in the **Measurements** setups to ensure the integrity of the Doppler results.

Deleting Measurements

Measurements can be deleted either from the displayed protocol or from the patient report. If the protocol is inactive, press the **CALCS** control. Use the trackball to highlight the measurement name corresponding to the measurement value to be deleted. Press the **DEL MEAS** control. The displayed measurement value is deleted. See "Patient Reports" for information about deleting or editing measurement values in the patient report.

New Measurements

Some measurements you perform may not have corresponding measurement names or labels that exist in the protocols. You might decide to measure something, and then need a place to store the measurement. You can create custom measurement labels or names for these measurements.

Use the trackball to highlight **NEW** in a protocol. The system will display a dialog box in which you can enter the new measurement label (Figure 7–2). Each measurement that you create will appear in the corresponding protocol. To delete a New or custom measurement label, select the measurement label, and press the **DEL MEAS** control.

If there is a current measurement value in the results, the measurement value will automatically appear under the **NEW** measurement label. The measurement label holds four measurements. Additional measurement values, in excess of the four, which are added to the label, result in the deletion of the oldest measurement.

The custom or **NEW** measurement labels and their corresponding measurement values become part of the patient report.

OB fetal tables or fetal growth curves cannot be associated with **NEW** or custom measurements. For information about OB fetal tables and fetal growth curves, refer to the OB portion of this section.

" **To create a new (user-defined) measurement label for the current exam:**

1. Perform the measurement, or create the new measurement label before performing the measurement. You must freeze the display before you can enter measurements into the protocol under the new measurement label.
2. Press the **CALCS** control to display a protocol list on the Calcs menu.
3. Highlight the desired protocol, and press **SELECT**. The highlighted protocol is displayed.
4. On the protocol, highlight **NEW** and press **SELECT**. (You may need to use the trackball and **SELECT** to scroll down the protocol to find the **NEW** label.) A **New Measurement** dialog box appears (Figure 7–2).
5. Use the keyboard to enter a measurement label into the **New Measurement** dialog box. The measurement label field consists of a maximum of five characters.
6. Highlight **Accept** or **Cancel** and press **SELECT** to accept or cancel, as desired. The dialog box is removed. The new measurement appears in the protocol list and the patient report for the current exam. Selecting a new patient or going through a power cycle removes the new measurement label from the protocol.

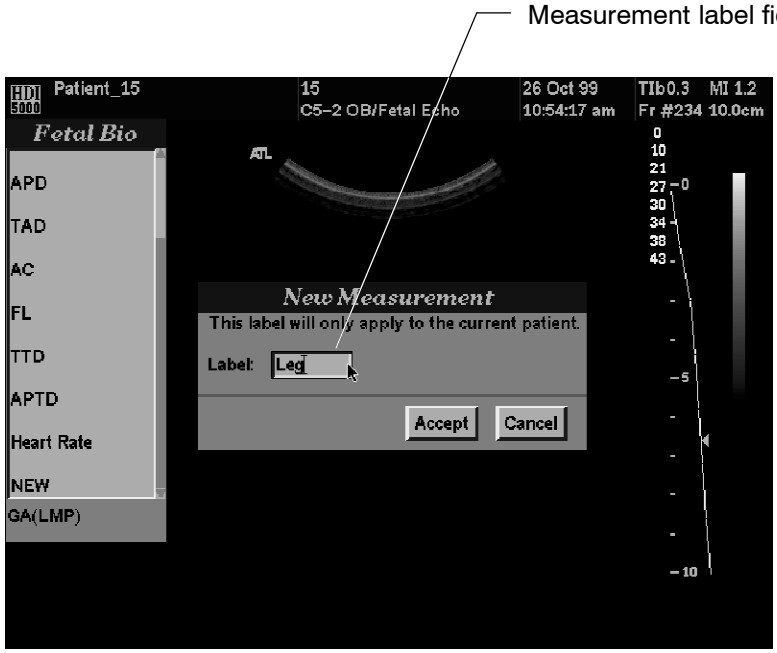


Figure 7–2. Creating a New (User-Defined) Measurement

Patient Reports

Patient reports present all exam information to you in an organized format. On the keyboard, press the **Report** key to display the patient report. The patient report will open at the page in the patient report that corresponds to the currently active protocol.

Patient reports vary in size and content. They can be longer or shorter based on the number and type of measurements that you make and the resulting calculations.

The patient report screens contain printing, editing, and page controls at the bottom to allow you to work in the patient report. Using the trackball and the **SELECT** control, these functions can be activated and the patient report can be previewed and edited.

The patient report is available in two forms: the **Final Patient Report** (Figure 7–3) and the **Patient Report–Edit Screen** (Figure 7–4).

Final Patient Report

The **Final Patient Report** contains the calculations derived from your measurements. The averages of several measurements are displayed in the final patient report, the component measurements are displayed in the **Patient Report–Edit Screen**. You must select **Edit** in the lower left corner of the **Final Patient Report** to display the **Patient Report–Edit Screen**.

Data Transfer

The **Data Transfer** selection will appear on the **Final Patient Report**, if the **Serial Output Port** in the **Peripherals** setups is set for **Data Transfer**. From the **Final Patient Report**, you can perform a data transfer. Data transfer allows you to spool patient report data to the serial output port. With your off-line software system you can archive, analyze patient report data off-line, and perform other research activities using data transfer.

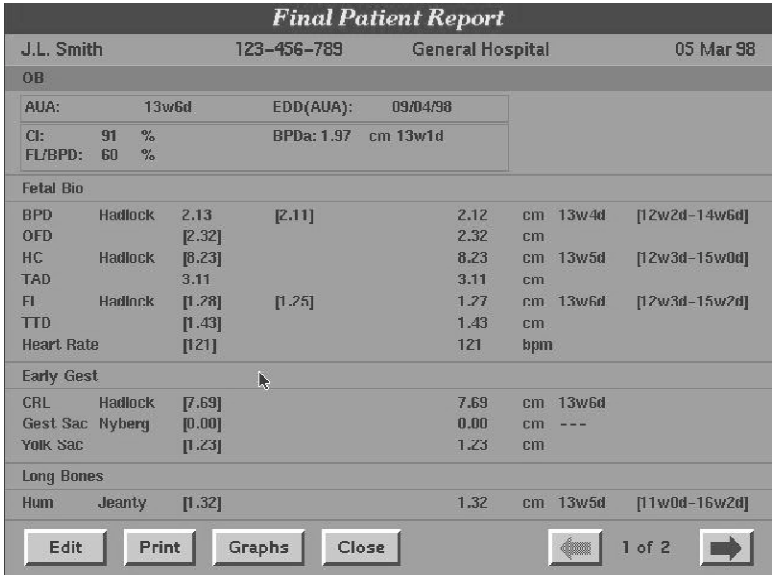
The data transfer format for the system is text-based and appears in the language configuration of the system, with the exception of the version information, which is always in English.

The patient data will be sent over the serial output port via a standard 9-pin, female-to-female, null modem cable. Serial port configuration is 9600 Baud, 8 data bits, no parity, and one stop bit. The Xon–Xoff protocol is used. The system sends data only. The only data that the system accepts is XOFF or XON characters. All data sent is valid and uninterpreted (an XOFF character is an ASCII 0x13 and not an indicator to stop sending). Text data is delimited with a TAB.

The exam information is transmitted in groups by exam phase, protocol, clipboard, comments, labels, and results.

Print

The **Print** selection at the bottom of the **Final Patient Report** allows you to print the patient report and any OB graphs to a serial printer. The **Peripherals** setup, **Serial Output Port**, must be set for the printer that you have connected to the serial output port.


Final Patient Report
J.L. Smith 123-456-789 General Hospital 05 Mar 98
OB
AUA: 13w6d EDD(AUA): 09/04/98
CI: 91 %
FL/BPD: 60 %
BPDa: 1.97 cm 13w1d
Fetal Bio
BPD Hadlock 2.13 [2.11] 2.12 cm 13w4d [12w2d-14w6d]
OFD [2.32] 2.32 cm
HC Hadlock [8.23] 8.23 cm 13w5d [12w3d-15w0d]
TAD 3.11 3.11 cm
FI Hadlock [1.28] [1.25] 1.27 cm 13w6d [12w3d-15w2d]
TTD [1.43] 1.43 cm
Heart Rate [121] 121 bpm
Early Gest
CRL Hadlock [7.69] 7.69 cm 13w6d
Gest Sac Nyberg [0.00] 0.00 cm ---
Yolk Sac [1.23] 1.23 cm
Long Bones
Hum Jeanty [1.32] 1.32 cm 13w5d [11w0d-16w2d]
Edit
Print
Graphs
Close
1 of 2

With printer selected in setups

With data transfer selected in setups

Figure 7–3. Final Patient Report (OB Example)

Patient Report–Edit Screen

The **Patient Report–Edit** screen is selected from the **Final Patient Report**. In the **Edit Screen**, the system calculations are displayed with the component measurements from which the calculations and averages were derived. You can select values on the **Edit Screen** and modify them; these changes will be reflected in the **Final Patient Report**. Dependent calculations, such as ratios and averages, are automatically updated when any values are changed. Comments can also be edited.

To look at other report pages, use the trackball to move the cursor to the arrows at the bottom of the screen and press the **SELECT** control.

More information about patient reports:

- The measurement name or label cannot be changed in the patient report.
- Calculated results cannot be edited. They are updated automatically as new measurement values are stored or edited.
- Only the last measurement value appears in the protocol. The last several measurement values, depending upon the clinical option appear in the report.
- Only one value of a measurement with multiple results appears in the protocol. All of the measurement values will appear in the patient report. For example: there are two angles calculated for the infant hip angle measurement; if you attempted to include this measurement in a protocol, only the value for angle A would appear in the protocol; both angle A and B values would appear in the patient report.
- Reports do not scroll, they can be paged through.
- () indicates that the measurement is not used in the average ultrasound age calculation.
- [] indicates that the measurement has been entered by the user or accepted as an edited value in the patient report.
- c indicates that a value is derived from an automatic calculation: for example, the automatic calculations of HC from BPD and OFD or AC from APD and TAD.
- In general, you can store three measurements into the patient report, before older measurements are automatically replaced with more current ones.
- You can store four custom measurements into the patient report, before older measurements are automatically replaced with more current ones.
- You can store ten cardiology Doppler measurements into the patient report, before older measurements are automatically replaced with more current ones.

- Measurement values will appear in the cardiology protocols and the patient report whether or not you press the **SELECT** control to end the measurement. If you do not end the measurement, and you do not want the measurement value in the protocol to appear in the patient report, use the **DEL MEAS** control to delete the measurement from the protocol.
- Measurements of a VCR frame-grab image will appear in the current patient report. If you do not want these measurements in the current patient report, enter the new patient data before measuring a VCR frame-grab image.
- To verify that OB ratios and measurements are within range, check the normal ranges displayed on the OB portion of the Patient Report. Out-of-range OB ratios and measurements are not otherwise identified.

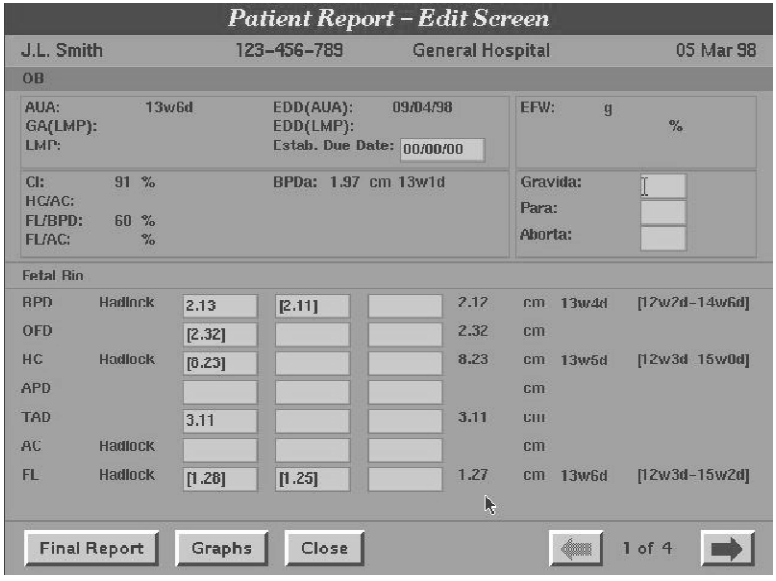


Figure 7–4. Patient Report: Edit Screen (OB Example)

Twins

Specifying in the patient data entry form that the exam is for a twin gestation allows you to set up the system and the protocols for a twin exam. The system will provide corresponding twin A and twin B protocols and patient reports.

References and any equations, tables, or growth curve values that support the **Fetal Biometry** protocol are contained in the “References” section.

Automatic Calculations (HC and AC)

When you enter measurement values into the **Fetal Biometry** protocol for BPD and OFD, the system automatically calculates the head circumference (HC). When you enter measurement values into the **Fetal Biometry** protocol for APD and TAD, the system automatically calculates the abdominal circumference (AC). These values will be included in the patient report and identified with a “c.” If you use the **AREA** control to measure AC or HC, the calculation derived from this measurement will override the automatic calculation.

Average Ultrasound Age (AUA)

AUA is calculated from all of the system-defined age measurements that have been performed during the current patient’s study. Estimated fetal ages are available in the reports for both twins. You can deselect or suppress ages from inclusion in the AUA. To suppress an age from inclusion in the AUA, move the cursor to the age and press the **SELECT** control. Parenthesis will indicate that the selected age is suppressed from the AUA calculation.

Gestational Age from Last Menstrual Period (LMP)

The gestational age (GA) derived from the last menstrual period (LMP) is based on the current system date minus the LMP date. The ultrasound age associated with a measurement in a protocol is derived from the most current ultrasound measurement. UA in the patient report is based on the mean of the fetal measurements. AUA and EDD based on the average of all UA’s obtained by measuring various fetal parameters are displayed in the patient report.

Estimated Date of Delivery (EDD)

The patient report includes the estimated date of delivery based on the average of all ultrasound ages obtained by measuring various fetal parameters. It also contains the estimated date of delivery based on the last menstrual period.

Established Due Date

The established due date is a user-entered date. If LMP is entered into the patient data entry form before the established due date is entered, the established due date is calculated from the LMP. If the established due date is entered before LMP is entered, LMP is calculated from the established due date, and this is indicated in the patient report by a “c” next to the LMP date.

Estimated Fetal Weight (EFW)

Estimated fetal weight will be calculated from the measurement values that you enter for the following:

- measure BPD and AC if you selected the Shepard EFW table
- measure FL and AC if you selected the Hadlock1 EFW table
- measure HC, AC, and FL if you selected the Hadlock2 EFW table
- measure BPD, HC, AC, and FL if you selected the Hadlock3 EFW table
- measure BPD, AC, and FL if you selected the Hadlock4 EFW table
- measure AC if you selected the Campbell EFW table.

Note *Ensure that the current measurement lies within the normal range on the fetal weight graph for the given gestational age. Viewing the fetal weight graph can help in the evaluation of the accuracy of the numerical fetal weight value displayed in the patient report.*

If no EFW appears in the patient report: 1) verify that you selected the correct table; 2) check the EFW table and verify that the measurements are within range for the table selected.

Fetal Ratios

The CI, HC/AC, FL/AC, and FL/BPD ratios are calculated when the component measurements are entered into the fetal biometry. For HC/AC the corresponding range for the ratio is also displayed when GA by LMP is within the specified age range for the ratio. The range is not displayed if the LMP is not entered. Incomplete or invalid ratios do not appear in the final report.

Fetal Growth OB Graphs

The growth graphs or curves provide you the capability to assess fetal growth relative to a normal growth curve or population distribution. The growth curve for a specific measurement type is displayed with the positive and negative standard deviations or relevant percentiles (Figure 7–5). The ultrasound age derived from your measurements is then plotted on the graph relative to the growth curve. Previous study data can also be plotted relative to the standard growth curve. Additionally, in the patient report, the percentile into which the estimated fetal weight falls relative to the total population is displayed (Figure 7–6).

Depending on the graph, the vertical axis is marked off in centimeters for measurements, percent for ratios, or grams for fetal weight. The graph has age in weeks along the horizontal axis. The age reference used to plot points on the horizontal axis is one of the following:

1. Manually entered established due date.

2. The age based on the date of the LMP entered into the patient data.

If neither the established due date nor the LMP is available, no points are plotted on the graph.

The twin gestation growth evaluation provides one graph with both sets of data. On the graph the twin A points are indicated by a “+,” and the twin B points are indicated by a “o.”

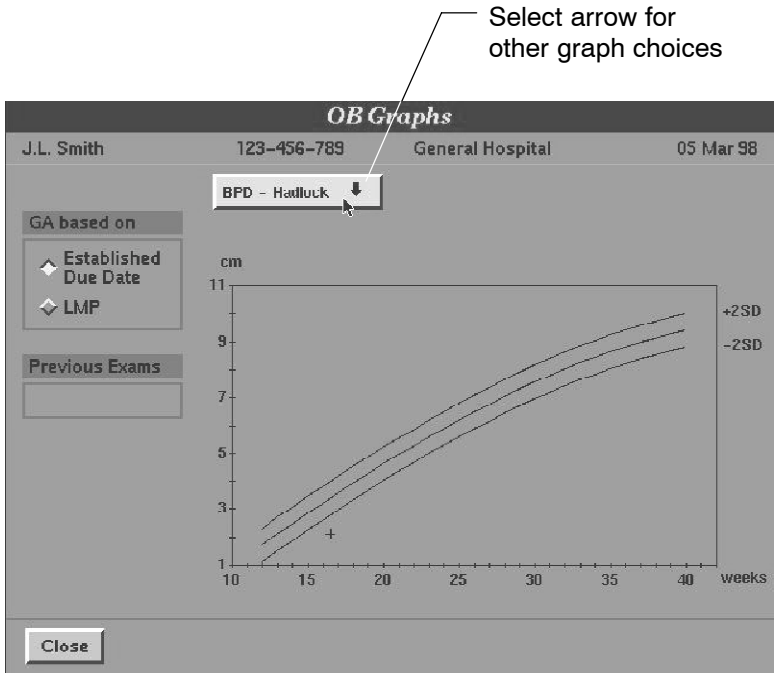


Figure 7–5. OB Graphs for Fetal Growth

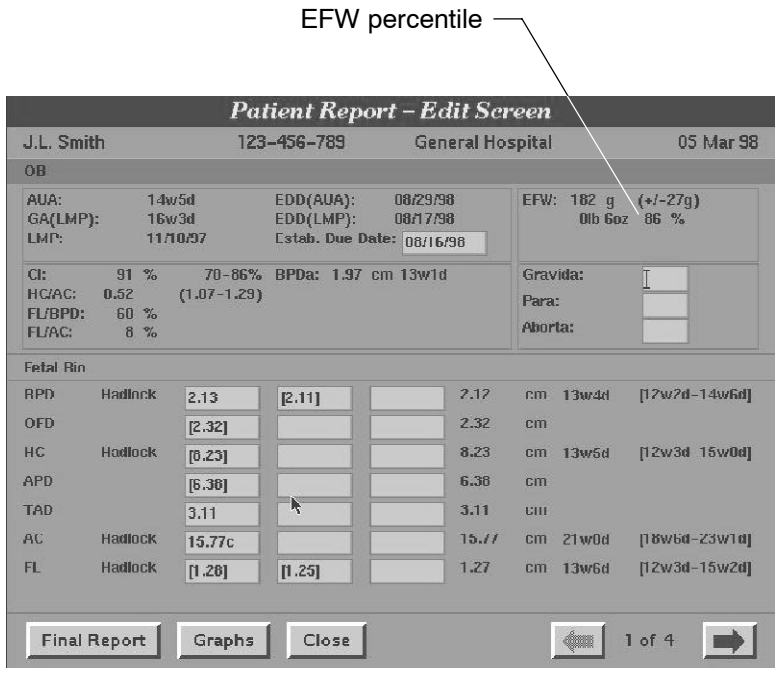


Figure 7–6. EFW Percentile

Printing and Recording

Printing

Printing can be performed using an internal device or an external device. The device can be a color printer, optical disk drive, black-and-white printer, report printer, or a camera. The system interface for printing is consistent across the range of compatible devices. For internal devices, the primary system print controls are located on the system control panel. The different print devices are all covered in the device manufacturer's operating instructions, which are included with each device shipped by ATL Ultrasound.

System Printing Controls

- The system must be set up for the print device. Setup is done in the **Peripherals** setups.
- With the Image Management option, you can set up the **PRINT** control and **Print Local** key for printing to a printer or to the configured archive devices. The setup is done using the **Image Management** setups.
- With the Image Management option, if you attempt to print several times in quick succession—averaging more than once every ten seconds for one minute—the system keyboard controls may become temporarily inoperable. Once the images that you have attempted to print have been stored on the hard disk, the keyboard controls will be operable.
- With the Digital Video Streaming (DVS) option, the **PRINT** control stores the image on the hard disk, and the **Print Local** key prints to the internal hardcopy device.

Printer Controls

The printer controls are explained in the manufacturer's instructions that accompany each device.

Printer Adjustments

ATL supports several different printers. Each printer manufacturer provides operating instructions for their printer. ATL, in turn, ships the manufacturer's instructions with each printer. The instructions that follow cover the ultrasound system printer interface and should be supplemented with the manufacturer's instructions to operate the printer.

WARNING All OEM devices, when external to the system, must be connected to a grounded outlet. Do not defeat the ground.

CAUTION

Do not operate a device if condensation is present inside the device. Before operating the device, replace a damp paper roll. The paper roll can be used after all traces of condensation are gone.

Notes S *Do not touch prints with wet hands, or the prints may fade.*

- *Store prints in a low-humidity location away from direct sunlight to avoid discoloration or deterioration of the image.*
- *When print paper absorbs volatile organic solvents such as alcohol, ether and ketone, the image will discolor or fade. Cellophane tapes and soft vinyl chlorides also may cause discoloration or fading. Also, avoid contact with wet diazo copies, as the image may fade away.*
- *Dirt or dust on the paper can result in poor-quality prints. Advance or FEED the paper until clean paper is visible.*
- *Paper loading instructions and diagrams are sometimes located inside the device door.*
- *If the paper is stuck or jammed, refer to the "Correcting Paper Jams" section of the manufacturer's instructions.*

Print Footswitch

The **Print** footswitch performs the same function as the **PRINT** control on the control panel. The **Footswitch** setup in the **Peripherals** setups must be set correctly to ensure that the **PRINT** footswitch works properly. The **Footswitch** setup allows you to use the left footswitch for recording or printing.

With the Digital Video Streaming (DVS) option, using an acquisition protocol, the footswitch assumes the same functions as the top three softkeys, instead of controlling printing. The left footswitch pedal corresponds to the top softkey, the middle pedal to the second softkey, and the right pedal to the third softkey from the top. After acquisition, the footswitch functions return to normal.

Report Printer

A report printer can be connected to the system serial output port. The report printer prints the selected OB graph or the patient report when the **Print** selection at the bottom of the patient report is selected. Ensure that the **Serial Output Port** setup, in the **Peripherals** setups is set for the **Okidata Printer**.

Adjusting Print Quality

Examine the print for print quality. If print quality is unacceptable, refer to the manufacturer's instructions for printer control adjustments that affect print quality.

Recording

For recording the High Definition video images generated by the system, ATL provides state of the art recording devices specially developed and manufactured.

ATL includes a copy of the manufacturer's operating instructions for your VCR with each system that contains a VCR. Please read the manufacturer's operating instructions before connecting, operating, or adjusting the VCR.

The information in this manual covers the controls, operation, troubleshooting, and maintenance as they relate to the system interface. VCR-specific information can be found in the manufacturer's operating instructions.

Do not use the VCR during system initialization. Erratic system behavior could result.

System Recording Controls

The VCR can be controlled from the VCR front panel or the following system controls.

RECORD

Press the **RECORD** control to record a sequence of images. Press the **RECORD** control, during a recording, to pause the VCR recording.

DOP GAIN

During VCR playback, the **DOPPLER GAIN** control can be used to change the tint of the color VCR playback display. Tint can be defined as the variation in color due to the addition of white to lessen the saturation. Turning the control clockwise increases saturation, turning the control counterclockwise decreases saturation.

COL GAIN

During VCR playback, the **COL GAIN** control can be used to change the color or saturation of the color VCR playback display. Color can be defined as the range or spectrum of color that is displayed. Adjusting **COL GAIN** changes the range of color displayed.

Microphone Key

Pressing the **Microphone** key enables the system microphone. Audio can then be recorded on the VCR audio track. A microphone graphic appears in the lower right of the display to indicate that the microphone is turned on.

Counter Key

Pressing the **Superkey** and the **Counter** key at the same time displays a dialog box that allows you to search the videotape and set the VCR frame counter. You turn on the system VCR frame counter in the **Peripherals** setups.

VCR CTRL Softkeys

Pressing **VCR CTRL** displays the following softkeys: **PLAY, PAUSE, STOP, FF** (fast forward), and **REWIND.** You can use these softkeys to control the VCR. The softkeys work just like the corresponding internal VCR controls.

VCR Footswitch

The VCR footswitch allows you to control recording. The **Footswitch** setup in the **Peripherals** setups must be set to **VCR Record** control. Pressing the left footswitch initiates recording, and pressing the left footswitch again pauses recording.

With the Digital Video Streaming (DVS) option, using an acquisition protocol, the footswitch assumes the same functions as the top three softkeys, instead of controlling VCR recording. The left footswitch pedal corresponds to the top softkey, the middle pedal to the second softkey, and the right pedal to the third softkey from the top. After acquisition, the footswitch functions return to normal.

Frame Grab

The **FREEZE** control frame-grabs during VCR playback or pause. When you press **FREEZE**, the system collects and holds three frames. Using the trackball, you can review these frames. Pressing the **PRINT** control takes a print of the frame.

Note *Frame-grab is not fully compatible with the DVS option, do not attempt frame-grabbing with the DVS option. Erratic system behavior could result.*

VCR Setup

The **Peripherals** setups must be set to reflect the correct VCR configuration. If the VCR is externally connected, verify the external connection, the setup, and then use the controls on the VCR for operation as required. The frame counter is also included in the **Peripherals** setups; it can be turned on in **Peripherals** setups, when the system VCR is enabled.

With the DVS option, the **VCR & Local Hardcopy Source** setup appears as a **Peripherals** setup. This setup allows you to determine the video source for the VCR and the installed hardcopy device. When **Live Image** is selected, the video to the VCR and the hardcopy device comes from the real-time image display. When **On-Screen Video** is selected, the video to the VCR and the hardcopy device comes from the DVS module. In review, the VCR and the hardcopy video always come from the DVS module.

Video Cassette

The VCR accommodates different sizes of video cassette tapes with different recording and playback times (Table 8–1). Use only the cassette tapes compatible with the VCR.

Table 8–1. Videotape Recording and Playback Times

Tape	Time (min)
NV-TV26	26
NV-T60	60
NV-T120	120
NV-ST120	120
NV-T160	160

VCR Record

Before recording, always make sure that the patient data is accurate. Pressing **RECORD** on the system control panel begins recording. Pressing **RECORD**, during recording, results in the VCR going into pause—the **PAUSE/STILL** control on the VCR (or **PAUSE s**oftkey) and the **RECORD** light on the system control panel flash during pause. Press **STOP** on the VCR (or the **STOP** softkey) to stop recording. The VCR footswitch (left footswitch control) works exactly like the **RECORD** control. The VCR has a video indexing system; refer to the VCR operating instructions for information on this topic or any related VCR topic.

Adding Voice Commentary

Voice commentary may be added to the audio track of the videotape. Ensure that the speakers are off and that the microphone is on before adding voice commentary.

VCR Playback

The videotape may be played at the same speed at which it was recorded or at variable speeds. The videotape can be played forward or backward.

Videotapes recorded at other than standard speeds will produce distorted video and audio characteristics when played. For best results, play the cassette in the VCR used to make the recording.

To play back the videotape at normal speed press **PLAY** on the VCR (or **PLAY s**oftkey). To pause the playback, press **PAUSE/STILL** on the VCR (or **PAUSE s**oftkey), or press the system **FREEZE** control.

When you press the **FREEZE** control, while the VCR is in playback, the system grabs three VCR video frames and the VCR enters pause. You can use the trackball to review the frame-grab video.

VCR playback with an external VCR—one connected to the rear of the system—is controlled with the VCR controls. To play back the video from the external VCR, press the **Superkey** and the **Video** key. The external VCR must be set up in the **Peripherals** setups.

VCR Frame Grab

To frame-grab a VCR playback image, during playback, press the **FREEZE** control on the system control panel. You can now review a sequence of images from a memory buffer in the system. Use the trackball to move through the image sequence of frame-grabbed images.

To measure a frame-grabbed image, a manual scaling calibration is required for the first measurement of a frame-grabbed image on each new patient. A scaling calibration consists of using display cursors to mark specific points on the frame-grabbed image. The distance, time, orientation, speed, or velocity characteristics of the recorded image are identified in the calibration so that the system can take into account the scaling that was used during the recording. Without this information the system would be unable to provide an accurate measurement or calculation for the frame-grabbed image.

Once the calibration has been performed, each subsequent attempt to measure a frame-grabbed image will be preceded by a prompt that asks you to accept the current calibration or perform a new calibration. If the scaling has not changed, you can accept the current calibration and perform the measurement. If the scaling has changed, then perform another calibration, as necessary.

Measurements of a VCR frame-grab image will appear in the current patient report. If you do not want these measurements in the current patient report, enter new patient data before measuring a VCR frame-grab image.

Dual images must be individually calibrated before measurement. At no time should you attempt to measure a VCR frame-grab image that does not display a scale by which you can calibrate that image.

The frame-grab image can also be annotated using the system annotation keys. Once you have captured the image, press **STOP** on the VCR (or **STOP s**oftkey): the annotation keys can be used to annotate the image.

Pressing the **Superkey a**nd the **Field A/B** key allows you to select between the two fields that make up a video frame. Once the image has been grabbed, the **STOP** control on the VCR (or **STOP s**oftkey) must be pressed to allow the use of the **Superkey** and the **Field A/B** key.

VCR Frame Counter

The system has a VCR frame counter, a set counter function, and a search tape function. The frame counter is turned on in the **Peripherals** setups. The search tape and the set counter functions are turned on with the **Superkey** and the **Counter** key.

When set in the **Peripherals** setups, the frame counter is displayed in the lower right corner of the display during recording and record/pause.

Pressing the **Superkey** and the **Counter** key will result in the display of a dialog box that contains a frame counter text field that can be edited, a **Search Tape** selection that initiates a search of the tape to the frame entered in the text field, a **Set Counter** selection that resets the frame counter to the entered frame setting, and a **Cancel** selection that cancels the operation. When you initiate a tape search, and the VCR reaches the frame that you set in the Frame Counter, the VCR will enter play/pause. If the VCR comes to the end of the tape, it stops.

The arrow keys on the keyboard and the **Backspace** key position the cursor in the text field of the frame counter dialog box. Pressing the **Return** key removes the dialog box.

All of the VCR controls are functional while the VCR frame counter is on and during the tape search. To cancel the tape search, press the **STOP** control on the VCR (or **STOP** softkey).

Connecting Peripherals

Peripherals are optional hardcopy devices or network options that can be connected to the rear of the system. Figure 8–1 shows the locations of the connectors on the rear of the system. Table 8–2 lists the devices that can be connected to the system. An arrow pointing into a circle represents an input to the system; an arrow pointing out of a circle represents an output from the system.

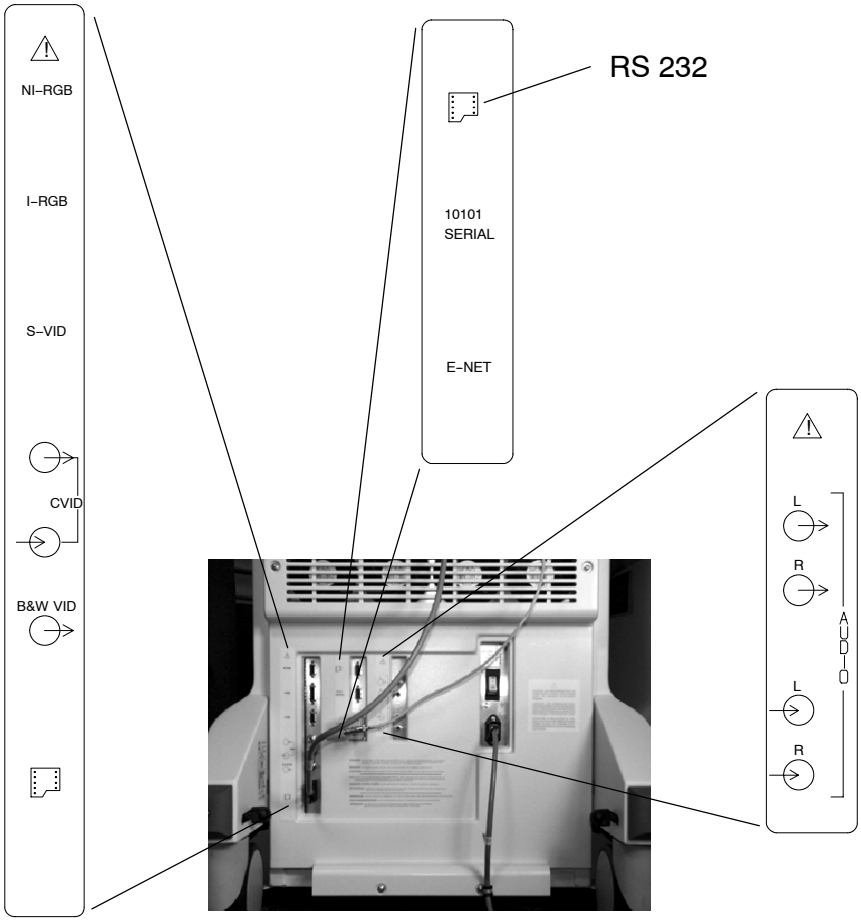


Figure 8–1. Connecting Peripherals

Table 8–2. System Peripheral Connections

Connector Name	Signal Type	Device Type	Notes
NI–RGBS	Non-interlaced RGB with separate composite Sync	Non-interlaced RGB video monitor	Provides 50 or 60 Hz non-interlaced video. When the system is in VCR playback or displaying hardcopy OSP setup information, the video to this connector is interlaced video.
I–RGB	Interlaced RGB with separate composite Sync	Interlaced video monitor or video printer	Supports video in and out with two sets of four video lines: RGBS
SVID	S-Video, NTSC or PAL standard	SVHS VCR or Access Acquisition Module	Supports video in and out. Consists of two sets of two video lines: Luminance and Chrominance.
CVID	Composite NTSC/ PAL video	VHS VCR or any composite video color device (color video monitor or color printer with composite only input)	Two BNC connectors: one for composite video out of the system; one for composite video into the system
B&W VID	Composite monochrome video	Black-and-white video printer or black-and-white display monitor	One BNC connector for grayscale video out of the system
	Parallel printer	Report printer	DVS option. See Figure 8–1, left bottom.
	RS-232A	Report printer	Okidata Printer. SeeFigure 8–1, middle top.
10101 SERIAL	Serial	Serial device	Data Transfer

Table 8–3. System Peripheral Connections (Continued)

Connector Name	Signal Type	Device Type	Notes
E-NET	Ethernet	Ethernet device	Network connection, also used for DVS option.
AUDIO L, R	Audio	SVHS VCR	Four RCA phono plugs: two, L and R, for audio out of the system; two, L and R, for audio into the system

Image Management

Introduction

Image Management functions include the storage, retrieval, and manipulation of ultrasound images. Image Management comprises DiskLink and NetLink.

WebLink connectivity refers to the link between the ultrasound system and the World Wide Web. The WebLink option functions include the transfer of image information over the Internet's World Wide Web.

DiskLink

DiskLink is the disk-based transfer of image information. DiskLink conforms to the Data Exchange File Format (DEFF) standard, version 2.5. Centralized printers, print servers, and network file servers that comply with the DEFF standard can take advantage of DiskLink.

DiskLink is a system option. With DiskLink, you can store ultrasound images on an optical disk or on the internal ultrasound system hard disk (Figure 9–1).

DiskLink uses the system hard disk and a 3.5-inch optical disk and disk drive. The 3.5-inch optical disk has a capacity of 128 MB or larger, and a minimum of 100 images. The internal system hard disk has a much larger capacity. The actual size of the hard disk is a function of technological advances, and increases in capacity which will continue to occur: currently systems have a hard disk with a capacity of over 2 GB.

Review of stored images is normally done at a viewing or workstation, but you can perform a cursory review of the stored images on the system monitor. Using DiskLink, images can also be electronically tagged with a print identifier, which allows you to generate a hard copy of the images using an optical disk printer.

The optical disk printer is separate from the ultrasound system and is specially set up by the printer manufacturer to allow you to print the images from the optical disk. Instructions from the manufacturers for the use of the viewing workstation and the optical disk printer are available with those products.

The DiskLink setups are included in two categories of system setups: General Options and Printer Selection (Figure 9–2).

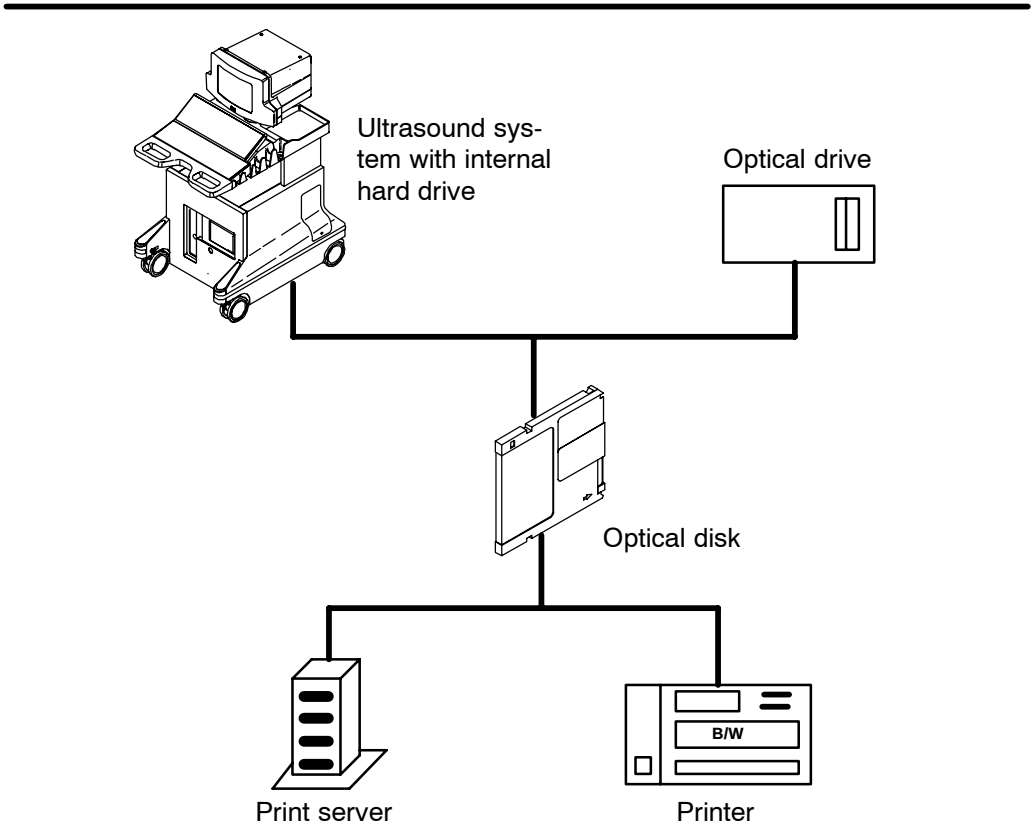


Figure 9–1. DiskLink

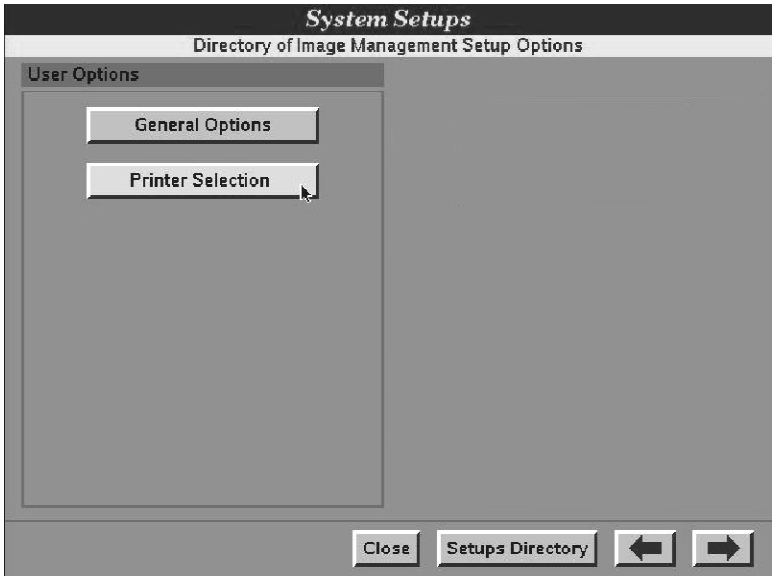


Figure 9–2. DiskLink Setups

NetLink

NetLink is the network transfer of image information. NetLink conforms to the Digital Imaging and Communications in Medicine (DICOM) standard, version 3.0. Centralized printers, print servers, network file servers, and review workstations that comply with these DICOM standards can take advantage of NetLink.

NetLink is a system option. With NetLink, you can store ultrasound images on the DICOM-compatible file server or archive device and review them using a workstation (Figure 9–3). You can also print exams directly. The NetLink setups are shown in Figure 9–4.

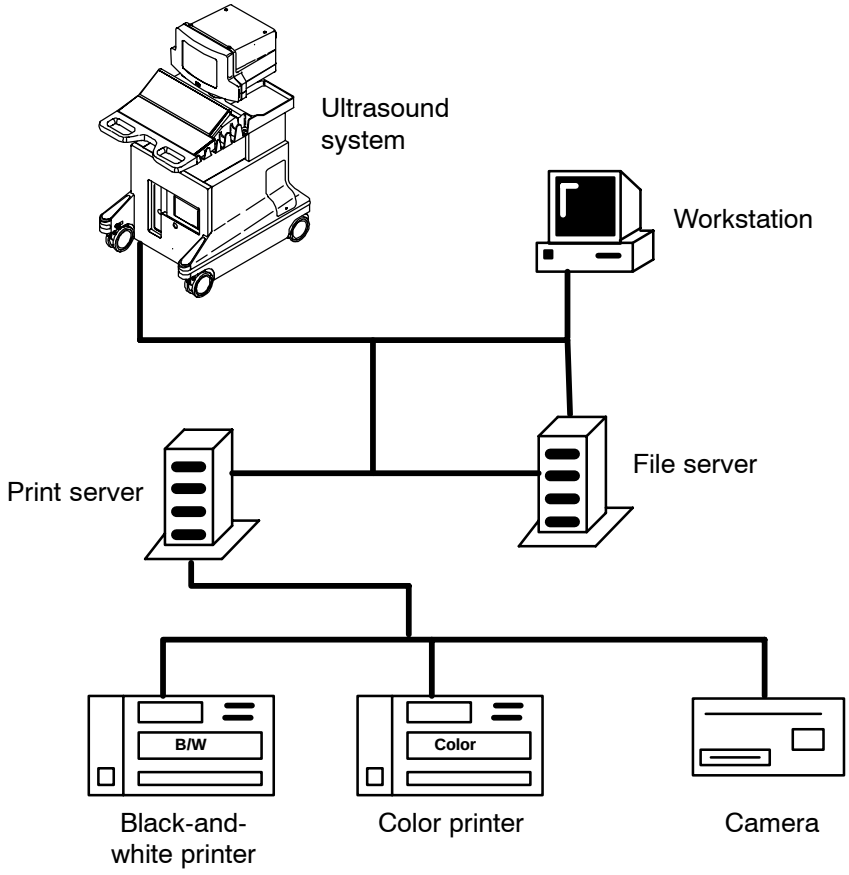


Figure 9–3. NetLink

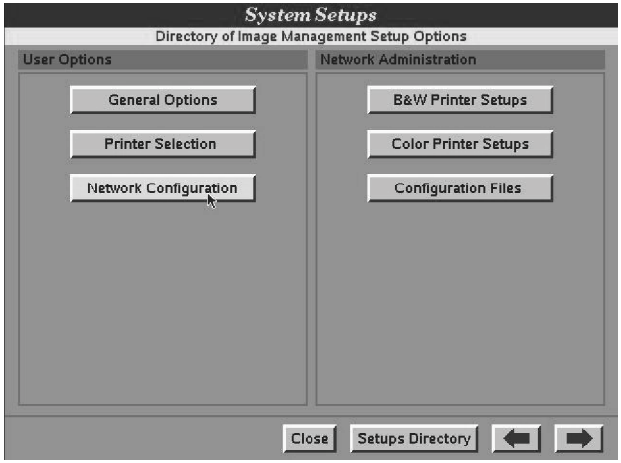


Figure 9–4. NetLink Setups

Network Pre-Installation Setup

The network can be configured entirely with cable supplied by ATL Ultrasound. However, more commonly you or your contractor will install the network cabling inside the facility walls. ATL provides the customer with cabling guidelines prior to installation. If in-wall cabling is used, it is your responsibility to install the correct type of cable in accordance with all applicable building and fire codes. You must also maintain the in-wall cabling for the life of the system. The most common type of cable used is 10Base-T (unshielded twisted pair).

Prior to the installation, you should install a dedicated analog phone line at the location where the file server is located. Once a modem is installed, ATL can access the system remotely to troubleshoot problems.

Before connecting new devices to an Image Management network, you should verify the device compatibility by calling ATL.

Before installing the NetLink option, ensure that the following steps have been completed:

- All in-wall network cabling is installed
- Any required gateway or router is installed
- All OEM equipment installers have been identified and contacted regarding the installation
- The system administrator (and backup person, if possible) has been identified
- The system administrator has the information listed in "System Administrator Information."

Network Cable Checkout

Refer to the network layout diagram to determine the LAN topology (Bus or Star) and the media type (10Base-2 or 10Base-T cable). You can also determine the cable type by checking the network connectors mounted on the wall. BNC connectors are used for 10Base-2 cable, and modular phone-type connectors are used for 10Base-T cable.

10Base-T cable does not require terminators. When 10Base-2 cable is used, ensure that the LAN is terminated at both ends with a 50-Ohm terminator. Some LANs will have terminators already installed inside the walls; others will not, and you will have to install them. The network layout diagram should show where the ends of the LAN are located and whether they are terminated.

Ensure that you follow the cable scanner manufacturer's instructions for testing the network cable. All LAN attachment points should be tested.

System Administrator Information

The system administrator is responsible for providing:

- A list of all equipment that is part of the Image Management network
- Logical diagram of the network showing topology, subnets, etc.
- Diagram of the network
- Locations of equipment
- Locations of all LAN attachment points
- Locations of power outlets and connector types
- Locations of any dedicated analog phone lines
- All necessary Internet Protocol (IP) addresses and subnet information.

Configuration Files

The configuration files comprise the host table, device table, and the device files (Figure 9–5 through Figure 9–7). The primary vehicle for the configuration is the host table. The device table and the device files contain information that supports the host table. The device table cannot be edited. The host table and the device files can be edited. ATL suggests that the device files only be edited by an ATL Customer Service representative.

Syntax

The syntax for the host table entries is critical.

- Each line must end in a semicolon.
- At least one space must separate fields.
- Model ID is found in the device table and must be entered identically into the host table.
- The Alias cannot exceed 19 alphanumeric characters.
- The Title cannot exceed 64 alphanumeric characters.
- // are used to “comment out” text. When // precede a line of text, that text is ignored by the system relative to the configuration files. Comments are useful for system administration and editing the host table.

IP Address

Internet Protocol (IP) address consists of four fields of up to three digits separated by periods (xxx.xxx.xxx.xxx). The value assigned to each field must be within the range of 0 to 255. An IP address is required for each device on the network. Unused or spare network connection points also require an IP address. The system administrator provides the IP address.

Subnet Name

Each subnet requires a subnet name. Subnet names are arbitrary identifiers (Subnet1, VxLAN, etc.). The subnet name occurs several times in the host table, and the name must have the same capitalization in each occurrence. The system administrator provides the subnet name.

Subnet Mask

There is a subnet mask for each subnet. Subnet masks use the same format as IP addresses: for example, 255.255.255.xxx (where xxx is a sequential number starting with 01 and incremented by 1 for each additional subnet). The purpose of the mask is to “mask off” the IP addresses and distinguish between a subnet and an individual network node. The system administrator provides the subnet mask.

Alias

Each device on the network requires an alias. The alias is an arbitrary name that describes the device. The aliases for the ultrasound system and the archive devices appear in the Image Management System Configuration setups as the Network ID. The aliases for the printers appear in the Printer setups. The system administrator provides the aliases.

Port

The port for each device is found in the vendor’s DICOM Conformance Specification. ATL uses 104.

Title

DICOM title, or just Title in the host table, is a unique name assigned to a device for purposes of DICOM communication. The system administrator assigns titles to devices.

Model ID

The Model ID is found in the device table. The Model ID serves as a connection to the device file. The Model ID found in the device table and the Model ID entered into the host table must be identical. Some of the information in the device file appears in the System setups. The System setups provide the avenue by which you change these device attributes. You can change the device file, but ATL recommends that you do not change it.

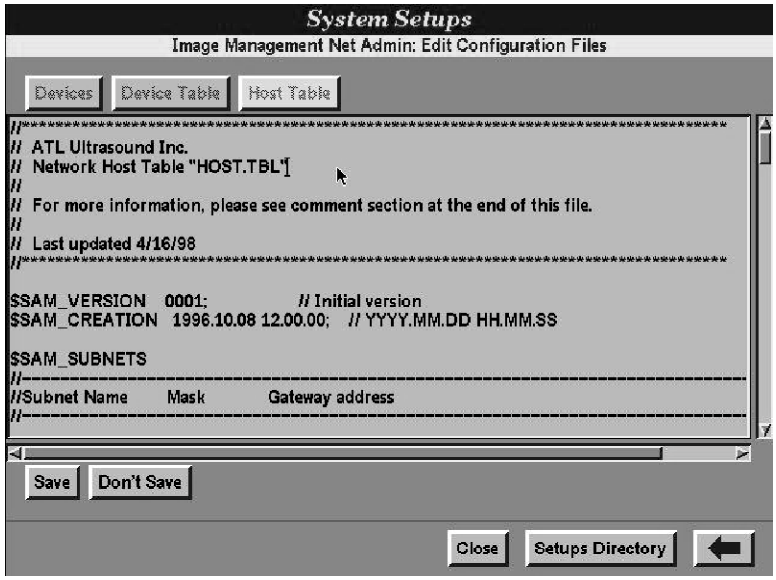


Figure 9–5. Host Table

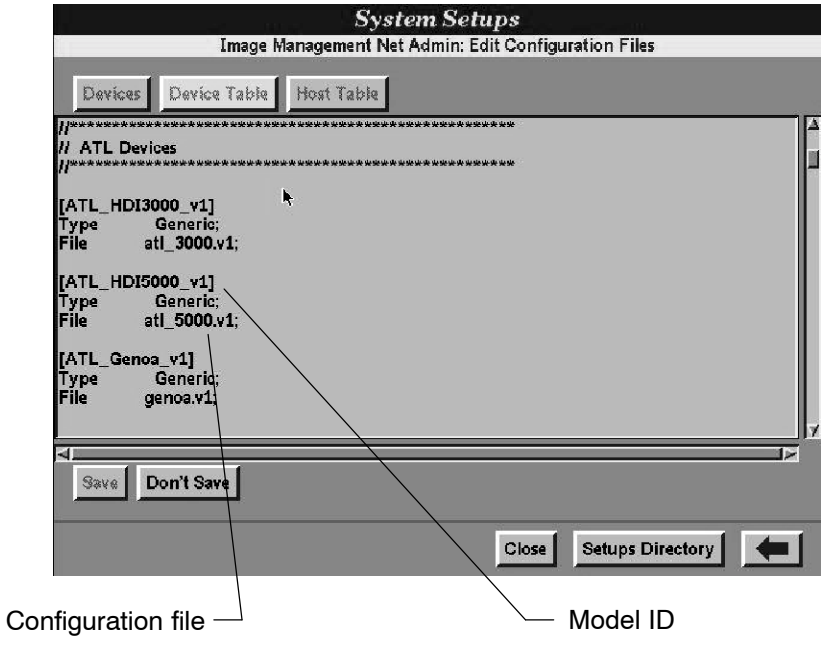


Figure 9–6. Device Table

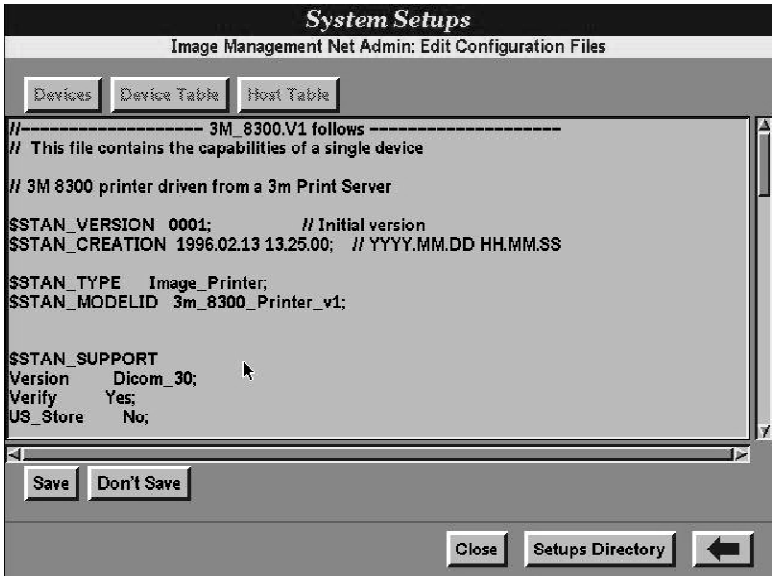


Figure 9–7. Device File

Ultrasound System Setup

The ultrasound system setup is done using the **Network Administration** setups, which are part of the Image Management system setups.

Host Table, Device Table, and Device Files

You must ensure that the following files reflect your network configuration:

- Host Table
- Device Table
- Device Files

The host table must contain the correct alias, IP address, port number, model ID, title, and subnet for each device on the network. The device table contains a mapping for each model ID in the host table to a file that describes the capability of the device with that model ID. The device files contain the capabilities of single devices that are potential network devices. These capabilities include such things as printer type, film size, film format type, orientation, destination, and density.

Most of the attributes or capabilities listed in the device file appear as setups on the **Image Management Net Admin: B/W Printers** and **Color Printers** system setups screens. From these screens you can select the settings for these setups. The relationships among the setups is dependent and logical. You must first select a printer type before the film sizes can be established.

The information in the host table, device table, and device files establishes the network configuration. This information must be consistent, or an error message will be displayed on the system monitor when you save the configuration files.

System Configuration

Procedures that support system configuration are described later in this section. The following steps provide an overview of the process:

1. Determine configuration information: all IP addresses, model IDs, subnet addresses or masks, device aliases, and port numbers. Your system administrator should have this information, or you can ask your Customer Service representative for assistance.
2. Use the configuration information and a site disk, if available, to create the host table, device table, and device files. You can use the ultrasound sytem to edit, install, and copy the configuration information.
3. Verify the accuracy of the syntax of these files by selecting **Apply** from the **Network Configuration** setups. If there are no errors, then the files are syntactically correct; otherwise, they are not, and a problem is indicated by an error message. Edit the files, fix the syntax, and apply until no errors occur.

4. After the host table, device table, and device files have been created, verify the network configuration. You use the **Image Management Network Administration** setups to do this. Make sure all the printers are displayed in the appropriate lists on the B/W and Color Printer setups panels. Make sure your ultrasound system appears in the **Ultrasound System Net ID** and make sure that all of the archive devices appear in the archive list.
5. Having verified the network configuration, create a backup copy of the configuration files on the system hard disk. You use the **Image Management Network Administration** setups to do this.
6. Select your printer and 1–4 of your archive devices. Create an exam, take several images, close the exam, and make sure that your images are printed and that the exam appears on all archive devices.
7. Later, you might want to add devices to the host table. This can be done using the Upgrade selection or by copying new configuration files.

Installation Verification

After the installation is complete, power up all the components and verify that the proper network connections are made.

1. Always turn on SCSI devices (i.e., optical drives) first.
2. Then power up the network file server peripherals and the file server. Allow the file server to boot up completely before you power up other equipment on the LAN.
3. Verify that all the system components function properly.

Completing the Installation

1. Label each network connection point with its alias.
2. Annotate the network diagram with the physical location of each installed network component.
3. Make a copy of the site disk.
4. File all manuals, software, tapes, optical disks, and computer keys.
5. Send the network diagram, a copy of the site disk, and the cable scanner to ATL.

Post-Installation

After installation and system verification, ATL is responsible for the following:

- Maintaining logical and physical diagrams
- Maintaining the site-specific site disk, modifying it as required. (A current copy of the site disk should be available on-site.)
- Maintaining a contact and phone list

System Administrator Responsibilities

The system administrator is responsible for the following:

- Site Information Systems (IS) department
- Cable installers
- Non-ATL equipment manufacturers
- Serving as the primary contact person for Image Management network issues
- Performing regular backups
- Network device maintenance
- Coordinating and facilitating repairs and updates to devices, as required
- Reporting any problems to ATL

Site Disk

The site disk contains all the configuration and setup files for network devices. The site disk contains files for the host table, device table, and device files. These files establish the following relationships:

- TCP/IP addressing for server and clients on the network
- DICOM print connections
- Print media selection
- Print media size selection
- Print film type selection
- Print orientation selection
- Print contrast and density settings
- Print format
- DICOM storage device connections

The part number of the site disk is 4251-0806-XX, where XX is the most recent version of the site disk. You can get a site disk from the system administrator at your site or by calling your ATL Customer Service representative.

WebLink Option

WebLink connectivity provides network transfer of image information over the World Wide Web. The WebLink option conforms to the Hypertext Transfer Protocol (HTTP) standard, version 1.0 for Web-based operations. With the WebLink option configured, you can use a client computer at a remote location to view images, which have been stored on an internal ultrasound system hard disk. The ultrasound system must be equipped with a web server. A password is required for access to the WebLink option.

The web browser that you use with the WebLink option must comply with HTTP standard version 1.0 and HTML standard version 3.0. Examples of usable web browsers include Netscape Navigator standard version 3.0 and 3.1 and Microsoft Internet Explorer standard version 3.0 (Figure 9–8).

WebLink Equipment Considerations

A 24-bit color monitor is necessary for adequate WebLink feature operation. Image display will be inadequate with monitors that have less color resolution.

Ensure that your browser is configured to refresh or reload memory on every visit to the Web page. Depending upon your browser, the name of this setting varies. The purpose of the setting is to ensure that you are seeing current updates of images on the ultrasound system hard disk.

Hypertext

Hypertext provides links that lead to other information when you select them. Hypertext is represented as colored, underlined text. All hypertext in the WebLink feature appears as underlined blue text (Figure 9–8). When you move the cursor over hypertext, the cursor becomes a hand. Hypertext links allow you to move around the Web.

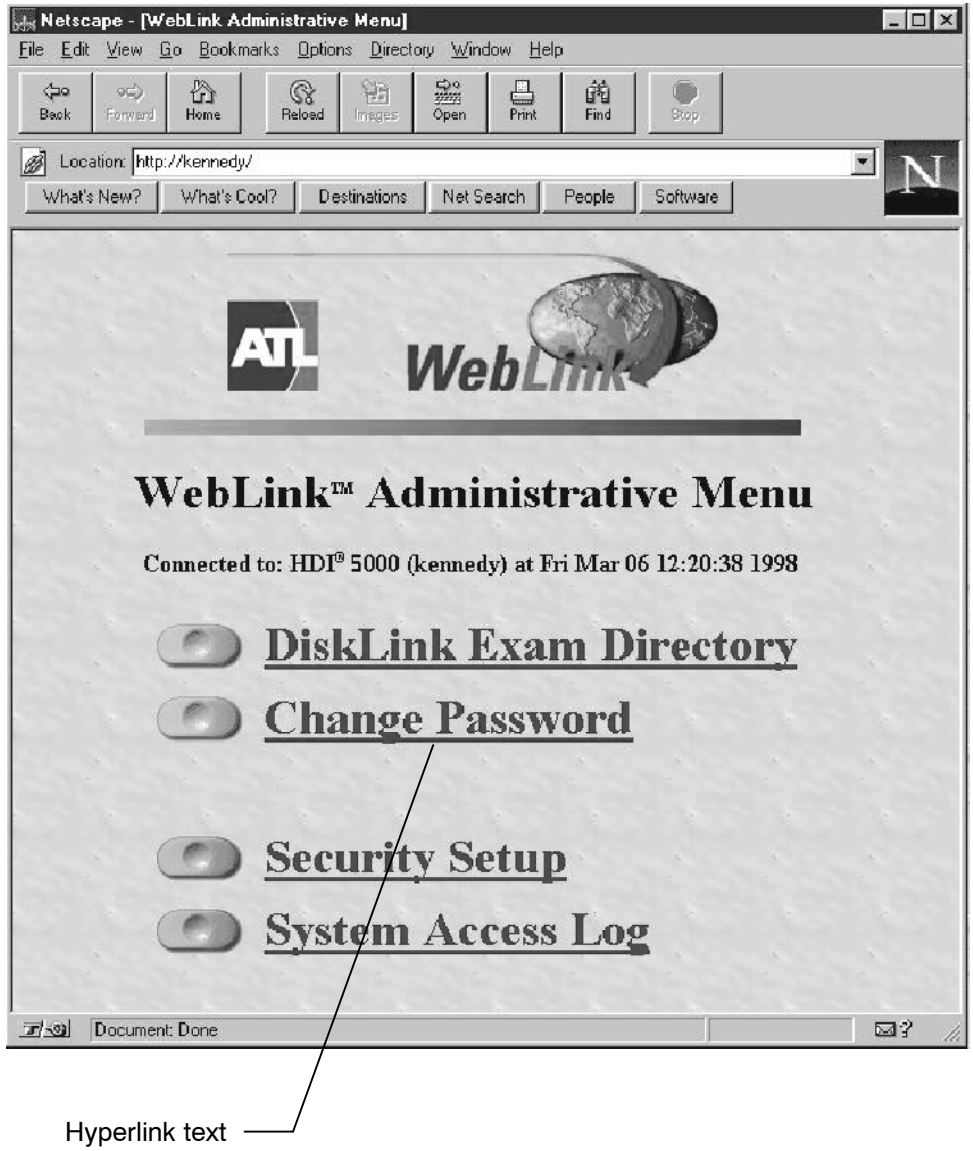

Netscape - [WebLink Administrative Menu]
File Edit View Go Bookmarks Options Directory Window Help
Back Forward Home Reload Images Open Print Find Stop
Location: http://kennedy/
What's New? What's Cool? Destinations Net Search People Software
WebLink
WebLink™ Administrative Menu
Connected to: HDI® 5000 (kennedy) at Fri Mar 06 12:20:38 1998
DiskLink Exam Directory
Change Password
Security Setup
System Access Log
Document: Done
Hyperlink text

Figure 9–8. Web Browser: Netscape Shown with WebLink Menu

Hyperlink Images

Hyperlink images are images that provide links that lead to other information when you select them (Figure 9–9). WebLink images are generally differentiated from static images by a thin, colored border around them. Selecting the **Home** hyperlink displays the home page.

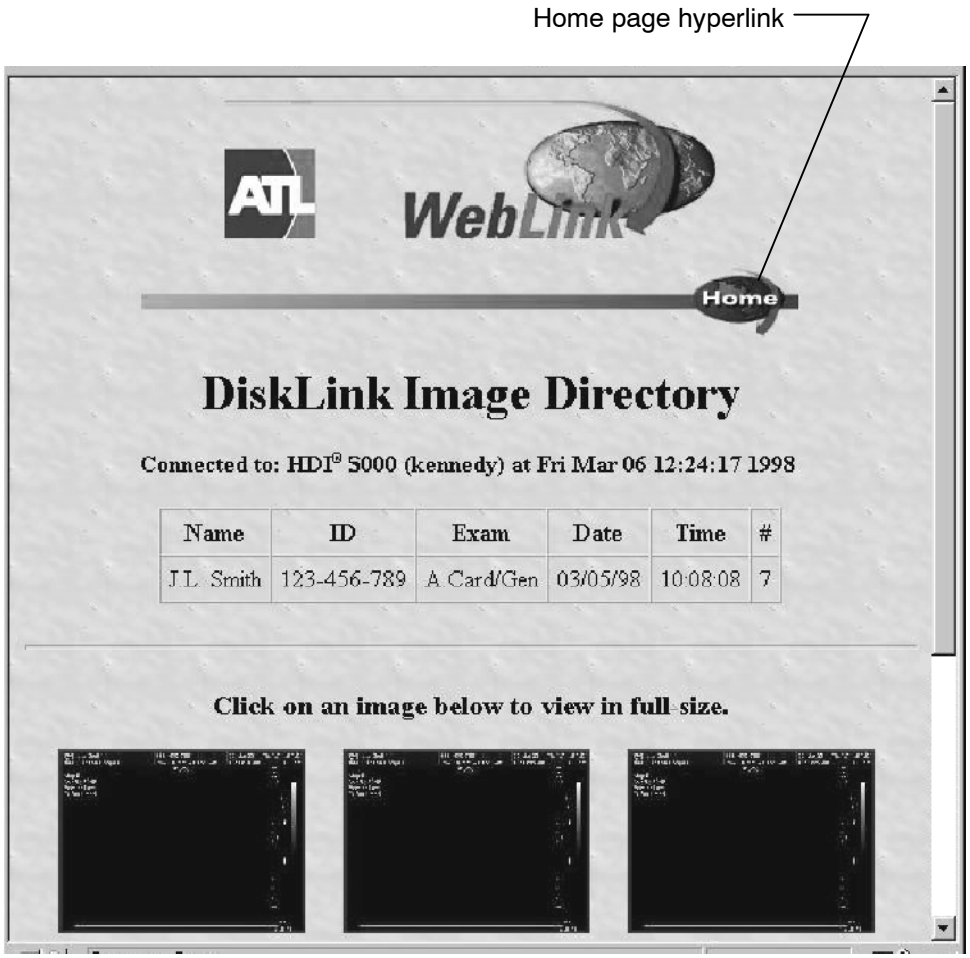


Figure 9–9. Web Browser: Hyperlink Images

WebLink Display

The elements of the WebLink display are listed below and shown in Figure 9–10.

- Page title centered at the top of the page
- Machine identification
- Current date and time

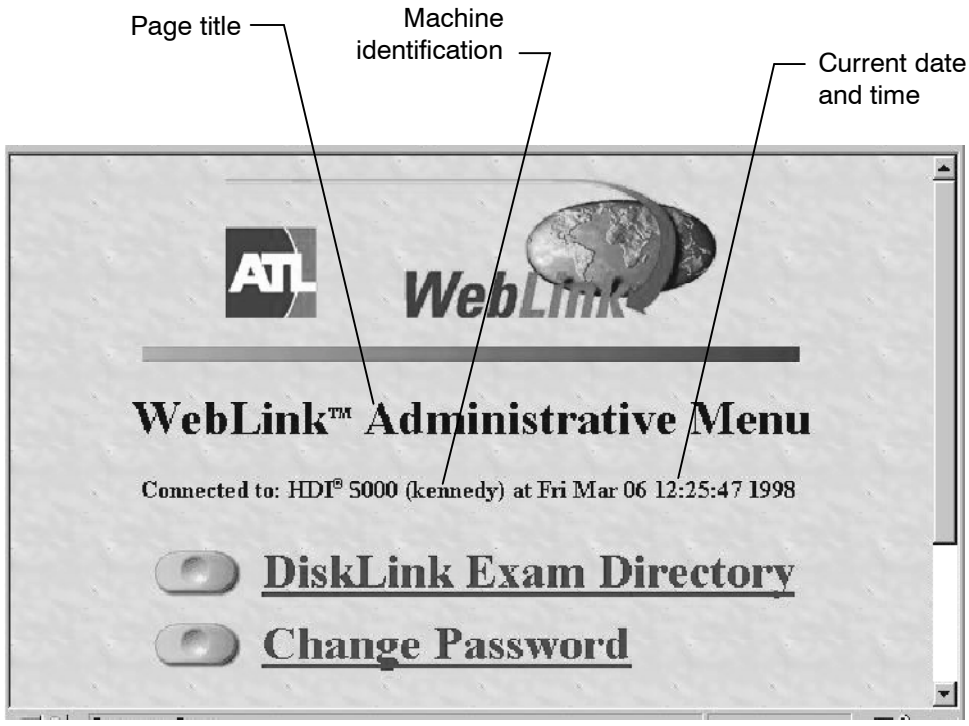


Figure 9–10. Web Browser: WebLink Display

WebLink Functions

Password

Access to the WebLink feature is controlled. You must have a password and a user identification. When you start your Web browser and connect to an HDI 5000 system with the WebLink feature, you encounter an authorization dialog box (Figure 9–11). To start the WebLink feature, you enter your user ID and password into the required fields. There are two selections on the password display: **OK** and **Cancel**. **OK** is used to submit your password and user ID; **Cancel** is used to cancel the submittal. The initial User ID is “admin”. The initial password is “weblink”.

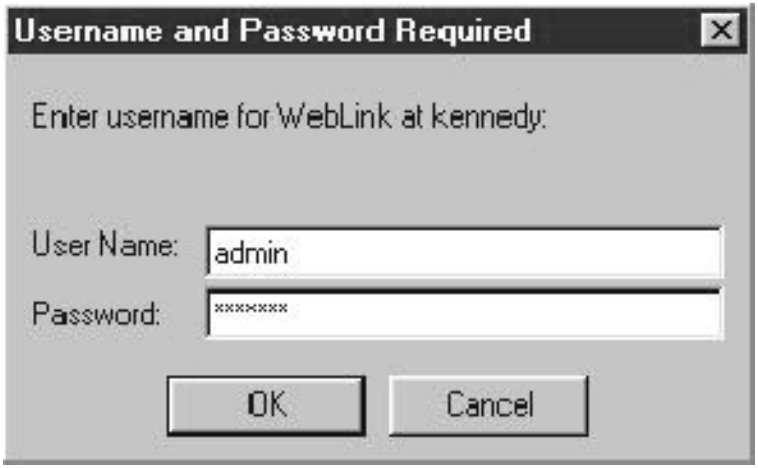


Figure 9–11. Authorization Dialog Box

Main Menu

The main menu consists of a page header and hyperlinks that allow you access to other WebLink pages: **DiskLink Exam Directory** and **Change Password** (Figure 9–10).

DiskLink Exam Directory

The **DiskLink Exam Directory** page consists of a page header and a table containing a header line and zero or more additional lines providing information about exams that are currently stored on the system using the DiskLink option (Figure 9–12). Each line contains the patient name (if enabled—see “WebLink System Administration” in this section), ID, exam, date, time, and # (the number of images stored for that exam). Name serves as the hyperlink to the image directory for the patient exam. If name is not shown, then the ID serves as the hyperlink to the image directory.

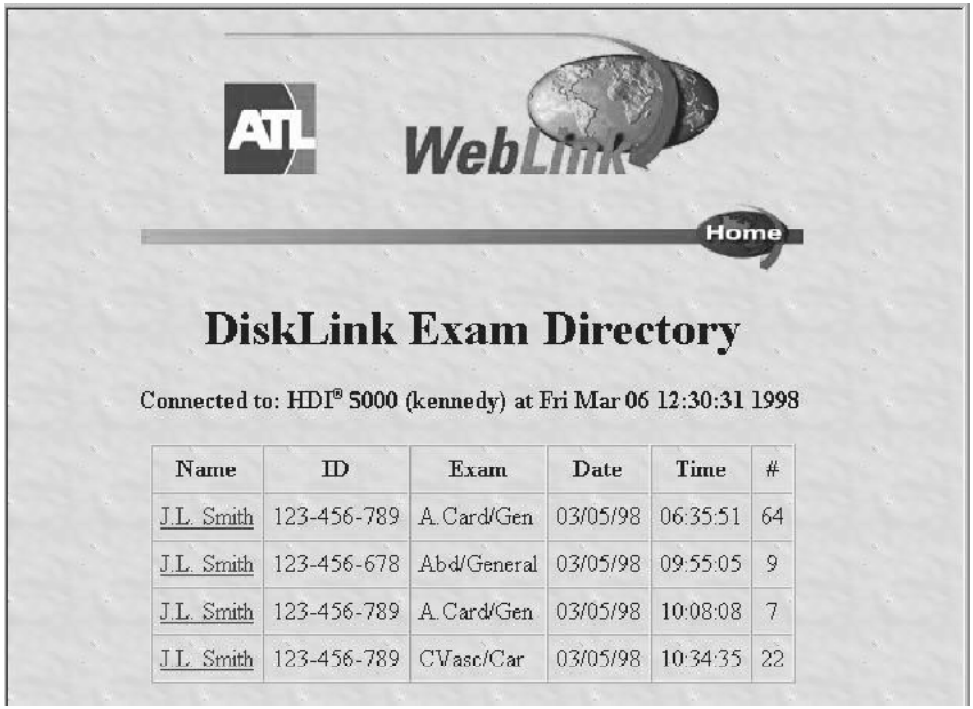

ATL
WebLink
Home
DiskLink Exam Directory
Connected to: HDI® 5000 (kennedy) at Fri Mar 06 12:30:31 1998
Name ID Exam Date Time #
J.L. Smith 123-456-789 A.Card/Gen 03/05/98 06:35:51 64
J.L. Smith 123-456-678 Abd/General 03/05/98 09:55:05 9
J.L. Smith 123-456-789 A.Card/Gen 03/05/98 10:08:08 7
J.L. Smith 123-456-789 CVasc/Car 03/05/98 10:34:35 22

Figure 9–12. DiskLink Exam Directory

Image Directory

The image directory pages consist of a page header, a table containing information for the currently selected exam, some instructional text, and zero or more small images representing the images that are currently associated with the exam on the ultrasound system hard disk (Figure 9–9). Each small image serves as a hyperlink to a full-size image that corresponds to the smaller one.

Image View

The full-size image view consists of a page header, a line of text describing the compression used on the image and a full-size ultrasound image. The WebLink image is JPEG-compressed, and it has a notification banner indicating the image was compressed at a certain ratio of compression (Figure 9–13). Because WebLink images are JPEG-compressed for efficient transmission, they undergo a loss of data. This “lossy” compression is not likely to be noticed by the human eye. You should not measure WebLink images or use them for other than informational purposes.

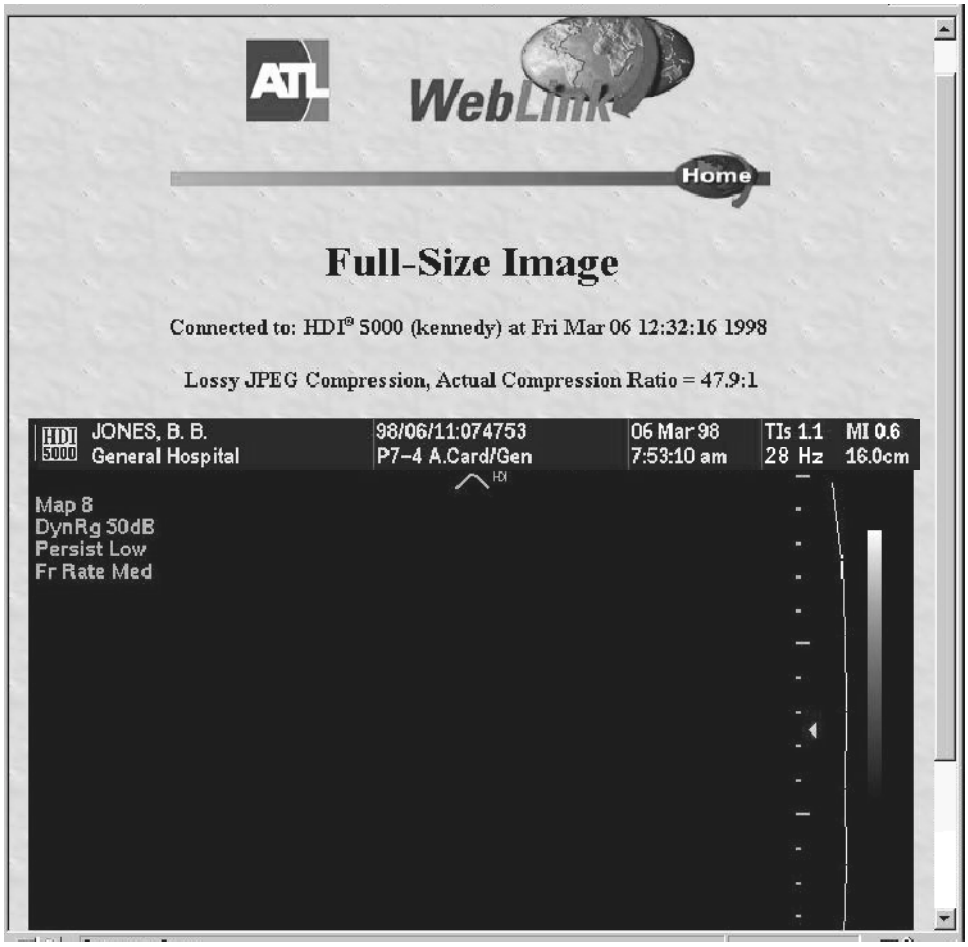


Figure 9–13. Image View: Full-Size Image

Change Password

The **Change Password** page consists of a page header, three text entry fields for password entry, and a **Change Password** selection to initiate the change (Figure 9–14). You enter your current password, the new password, repeat the new password, and then select **Change Password**. An incorrect current password or a mismatch between new password and repeat new password results in an error.

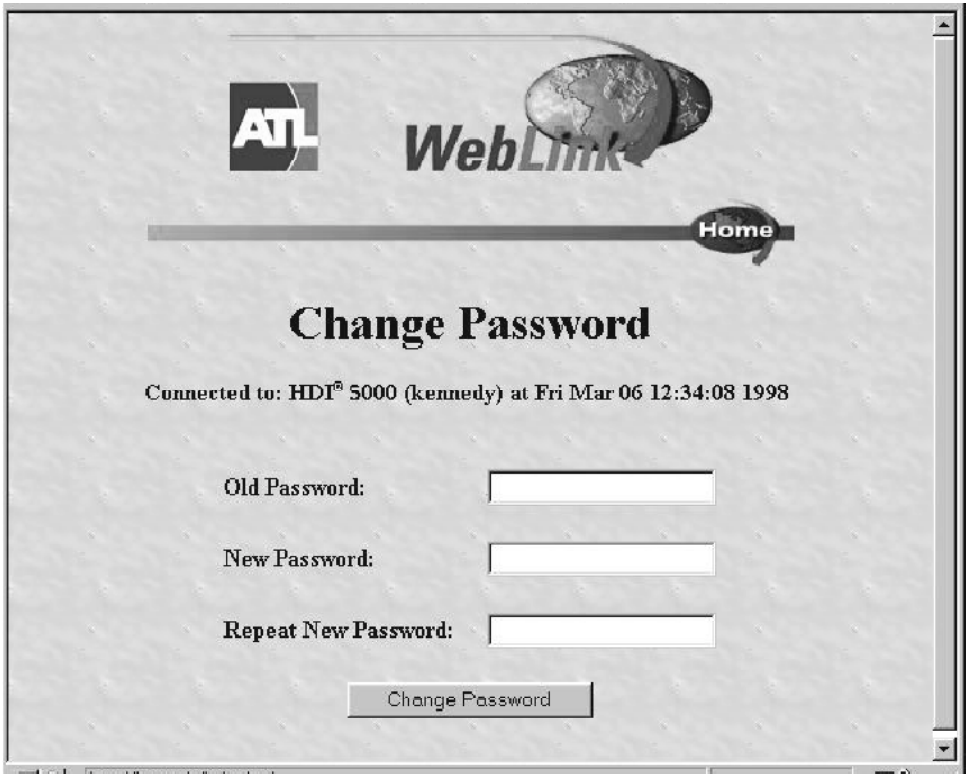


Figure 9–14. Change Password

WebLink System Administration

WebLink System Administration allows you to add or remove users who are allowed to use WebLink functions.

Password

Access to WebLink System Administration is also controlled. You must have a password and a user identification. You encounter an authorization dialog box, similar to that shown in Figure 9–11. To enter the administration screen you enter your user ID and password into the required fields.

WebLink Administrative Menu

The **WebLink Administrative** menu contains the same elements as the **Main Menu** with the addition of some hyperlinks for security setup and system access log (Figure 9–15).

Security Setup

Security setup allows the system administrator to add or remove users from the system and to set initial passwords. To add a user, you enter the user's real name, a user ID for logon purposes, and an initial password in the correct fields. Once this information is entered, you select **Add User** on the display. You must fill in all fields or an error display appears. If everything is correctly entered, the new user is added to the password database and a completion display appears.

All text entry fields are limited to a maximum of 20 alphanumeric characters.

Security setup also allows you to remove users. Display the user list by clicking on the drop-down list in the **User ID** field (Figure 9–16). Select the user for removal, and then click on Remove User.

Other Options consists of hiding patient names on the image displays. If you click on the **Hide Patient Names** button, then the patient names are not sent across the network.

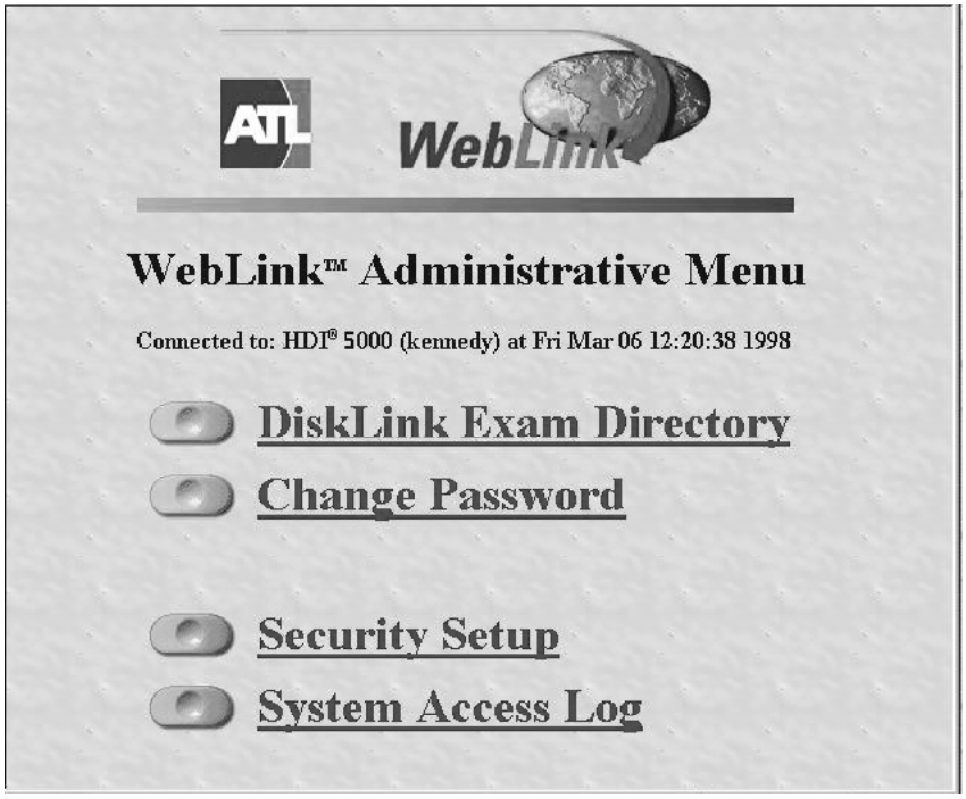


Figure 9–15. WebLink Administrative Menu

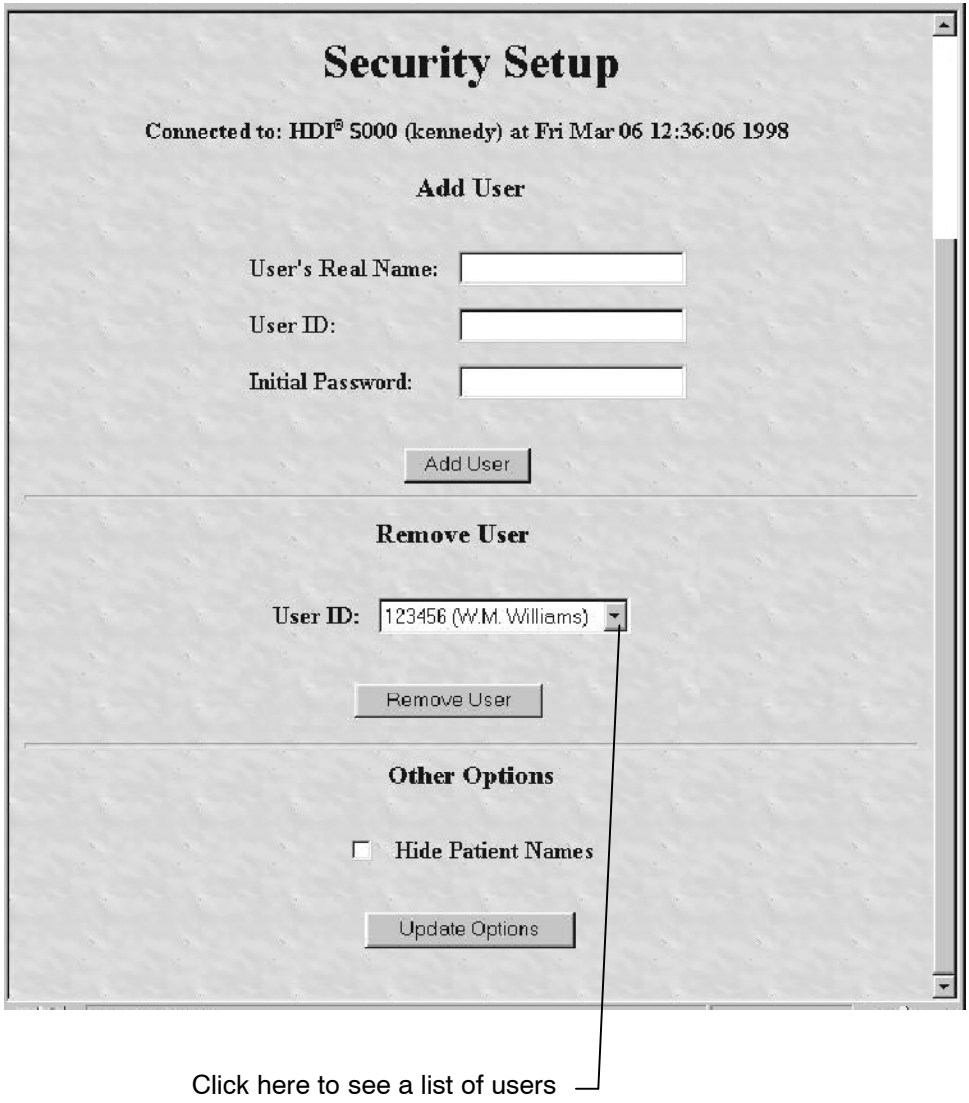


Figure 9–16. Security Setup

System Access Log

The system access log allows the system administrator to view a history of selected recent transactions on the server (Figure 9–17). The log contains the user ID associated with each access, the level of authority in effect during the access, the IP address of the computer used to make the access, and the uniform resource locator (URL) requested.

There are four color-coded authority levels: black is a normal access, green is an administrative access, cyan is a service access, and red is a failed access. The color coding may come in handy for identifying repeated failures from a certain host. The URLs displayed in the log are hypertext links, so that the system administrator can repeat the logged actions. Certain URLs may no longer exist—in this case an error page is generated.

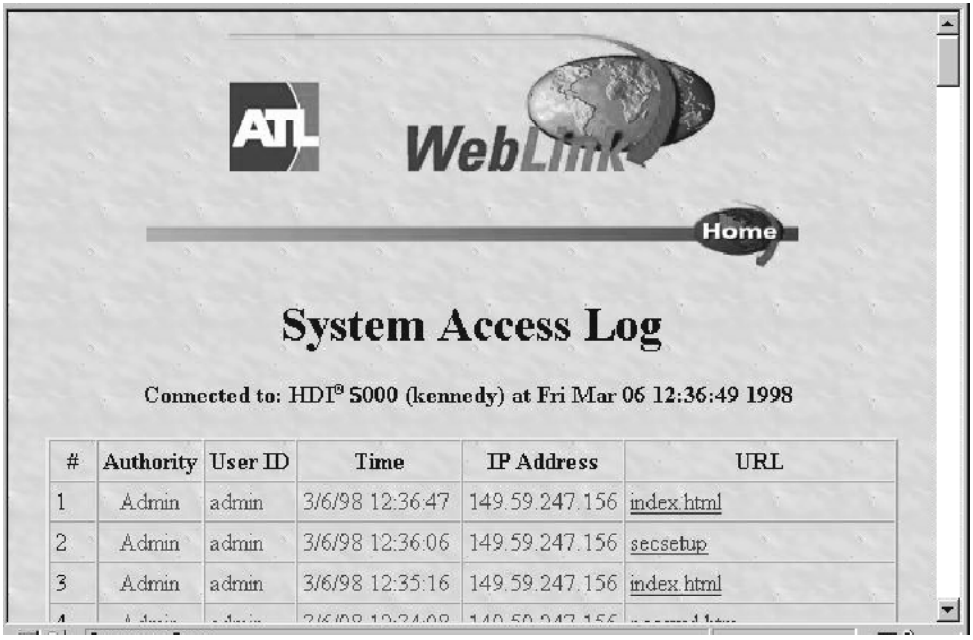

ATL
WebLink
Home
System Access Log
Connected to: HDI® 5000 (kennedy) at Fri Mar 06 12:36:49 1998
Authority User ID Time IP Address URL
1 Admin admin 3/6/98 12:36:47 149.59.247.156 index.html
2 Admin admin 3/6/98 12:36:06 149.59.247.156 secsetup
3 Admin admin 3/6/98 12:35:16 149.59.247.156 index.html

Figure 9–17. System Access Log

Image Management Setups

This section covers the basic tasks related to Image Management setup. Image Management is set up by your ATL customer service representative or your own system administrator.

The **Image Management** setups are available from the **Directory of Setup Options**. Once you select **Image Management** from the **Directory of Setup Options**, the options available to you depend upon the configuration of your system: DiskLink, NetLink, and the WebLink features require different levels of setup. Descriptions of all **Image Management** setups are in the "Glossary."

DiskLink Setup

The DiskLink setups are included in two categories of system setups: general options and printer selection. You can use them to do the following:

- Set up the **PRINT** control for either local print, using the installed printer, or storage to the optical disk and hard disk.
- Set up your print environment for either printing all of the images that you store to disk or selectively printing the images by tagging the images you want printed.
- Set up your system so that it will warn you when storage capacity is at a specific level or levels.
- Set up when images are to be sent to the optical disk: after each image is stored to the hard disk or at the end of the exam.
- Set up your review format: either one image or four images on the screen.
- Set up the sizes (number of images) of the black-and-white and color loops.
- Set up the automatic sending of pending images to a printer or storage device when the system is reconnect to the network.
- Set up your printer type, film format, user number for printing to the optical disk, print image destination, and number of copies to print. With the DiskLink option, this information does not set up the printer; it does set up the system for use with the printer, and it determines how the film format icon reflects printer configuration.

" **To set up your system for DiskLink operation:**

1. Press the **Setups** key. The **Directory of Setup Options** appears (Figure 9–18).

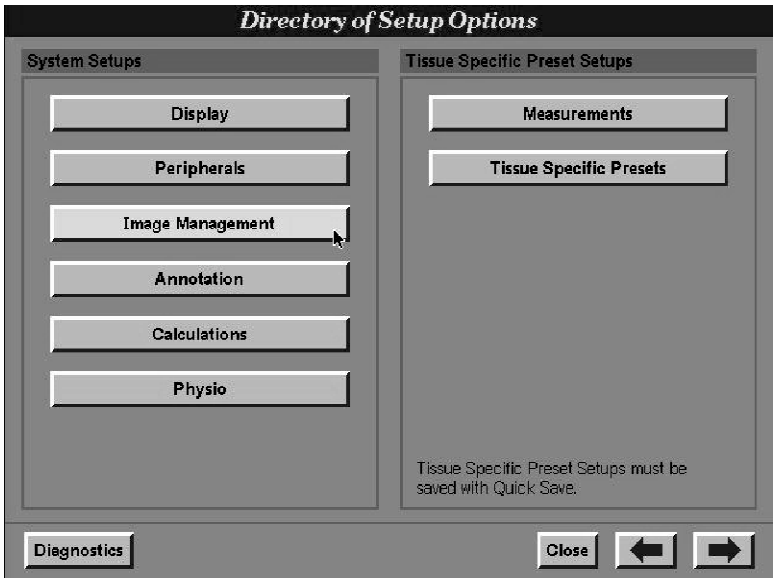


Figure 9–18. Directory of Setup Options

2. Select **Image Management**. The **Directory of Image Management Setup Options** appears (Figure 9–19).

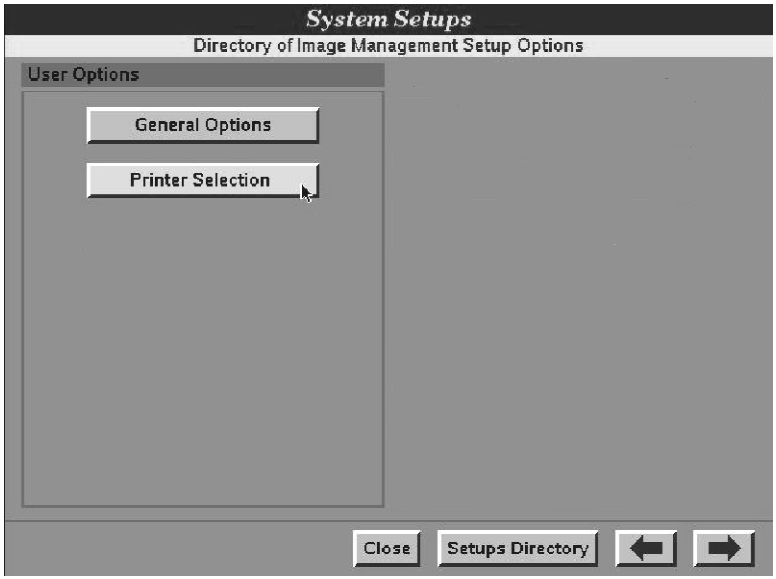


Figure 9–19. Directory of Image Management Setup Options for DiskLink Setup

3. Depending upon which setup you want to change, select **General Options** or **Printer Selection**. The **Image Management: General Options** or the **Image Management: Printers** setups appear (Figure 9–20 or Figure 9–21).

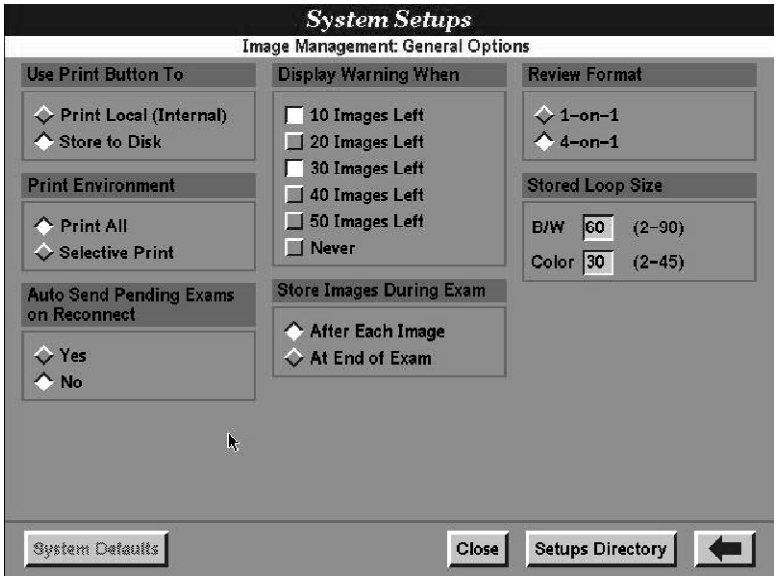


Figure 9–20. Image Management: General Options

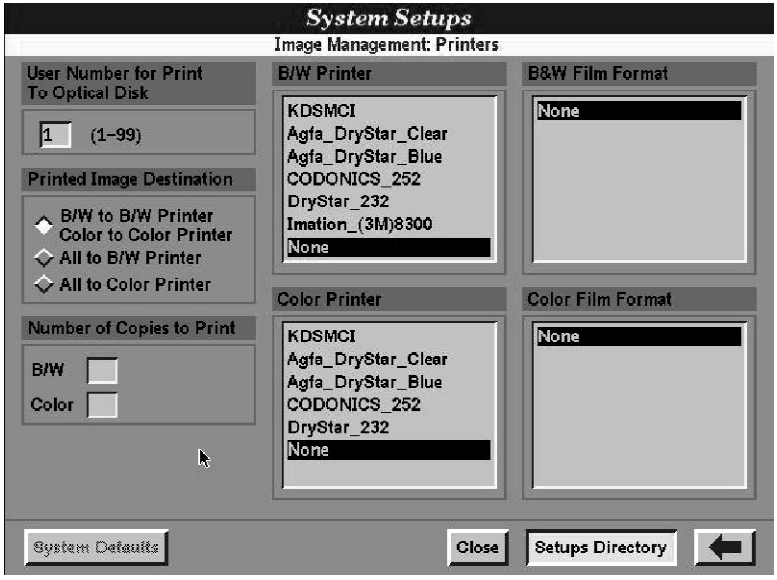


Figure 9–21. Image Management: Printers

4. Use the trackball and the **SELECT** control to set up your system. If you need help to decide which settings to select, refer to the descriptions of the setups in the "Glossary."
5. Once you have set the **General Options** and **Printers** setups the way you want them, select **Close**. The system is set up for DiskLink operation.

NetLink Setup

Before configuring your system, ensure that you have the following information:

- From your system administrator, get subnet, gateway, and IP address information for all devices and ultrasound systems on the network.
- From the DICOM Conformance Specification documents for the devices and the ultrasound system, get the port numbers. The port number for the ATL ultrasound system is 104.
- From the ultrasound system Device Table, get the model identification.

" **To configure your ultrasound system for NetLink operation:**

1. Press the **Setups** key. The **Directory of Setup Options** appears (Figure 9–18).
2. Select **Image Management**. The **Directory of Image Management Setup Options** appears (Figure 9–22).
3. Select **Configuration Files**. The Image Management Net Admin: Configuration Files appear (Figure 9–23).

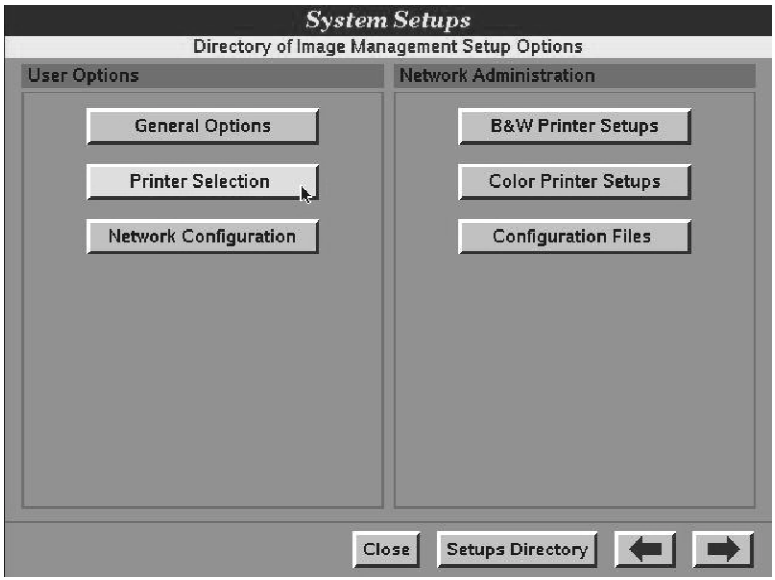


Figure 9–22. Directory of Image Management Setup Options for NetLink Setup

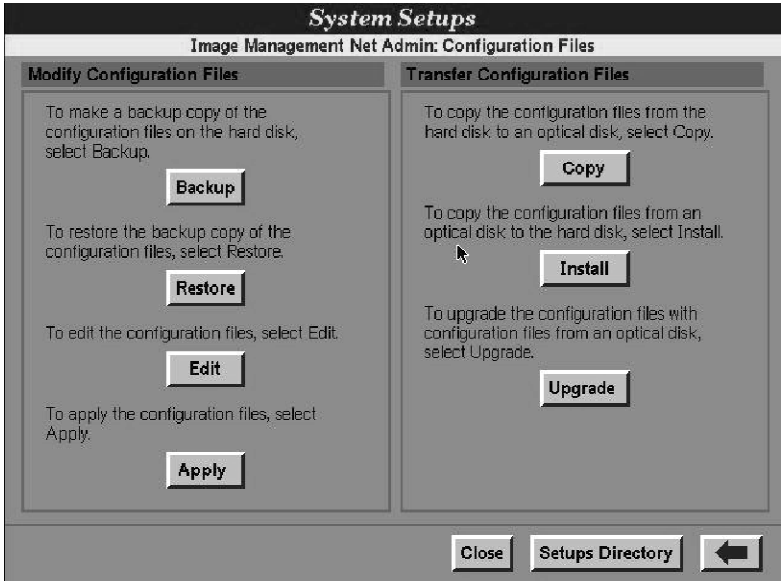

System Setups
Image Management Net Admin: Configuration Files
Modify Configuration Files
Transfer Configuration Files
To make a backup copy of the configuration files on the hard disk, select Backup.
Backup
To restore the backup copy of the configuration files, select Restore.
Restore
To edit the configuration files, select Edit.
Edit
To apply the configuration files, select Apply.
Apply
To copy the configuration files from the hard disk to an optical disk, select Copy.
Copy
To copy the configuration files from an optical disk to the hard disk, select Install.
Install
To upgrade the configuration files with configuration files from an optical disk, select Upgrade.
Upgrade
Close
Setups Directory

Figure 9–23. Image Management Net Admin: Configuration Files

4. Select **Edit**. The **Image Management Net Admin: Edit Configuration Files** appear (Figure 9–24).

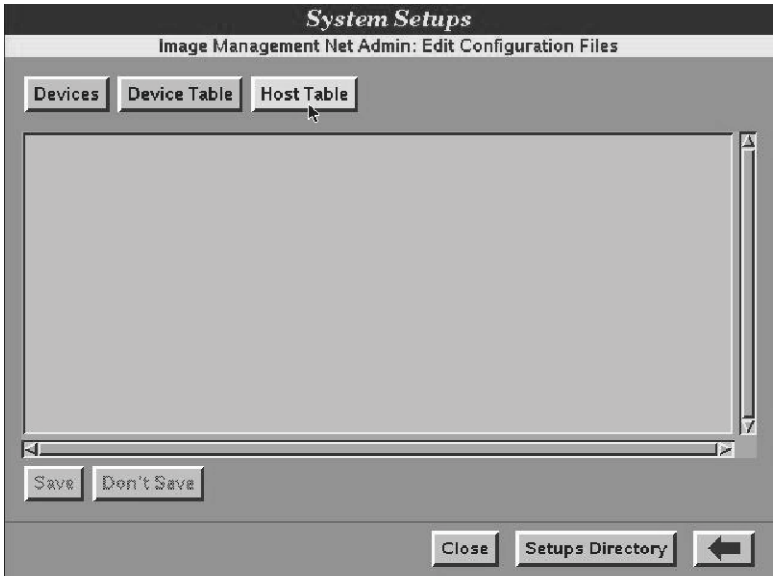


Figure 9–24. Editing the Network Configuration Files

5. Select the **Host Table**. The host table appears in the window beneath the selection (Figure 9–25). At the beginning of the host table, there are some descriptions of the entries that are required in the configuration files.

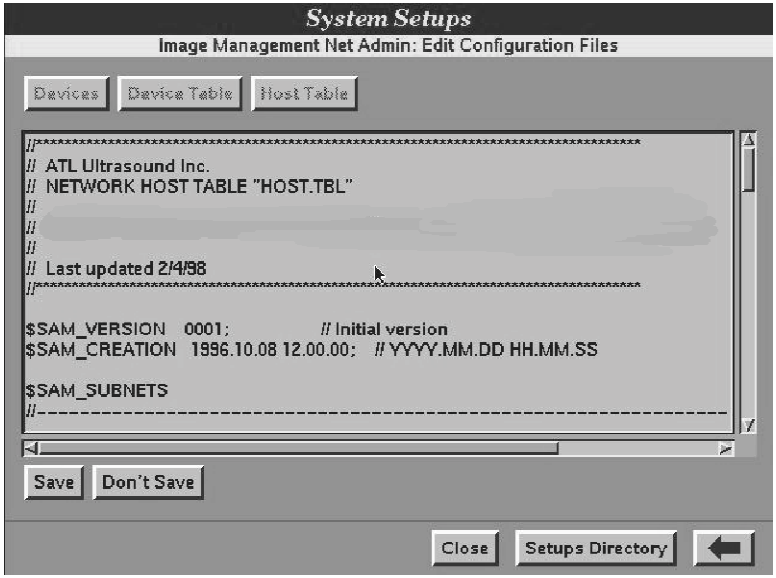


Figure 9–25. Editing the Network Configuration Files: Host Table

6. Scroll down to the the **Subnet** area of the host table (Figure 9–26).
7. Use the trackball to move the cursor beneath **Subnet Name** in the **Subnet** area of the host table.
8. Press the **SELECT** control to locate the cursor in the host table. There is an example of a subnet entry entered into the host table template:
   //GenLab 255.255.255.0 192 168.1.30;
   You can delete the example, or leave it; the // that precede the example indicate that this line of text is a comment, and as such, it is not part of the configuration files. If appropriate, you can delete the // and modify the example for your subnet.
9. Use the keyboard to enter the subnet name, mask, and the gateway address for each subnet on the network. Ensure that you observe the following conventions (Figure 9–26):
   - The subnet name is type case-sensitive.
   - The mask and IP address, which you get from your system administrator, must follow accepted rules of syntax.
   - Each line of text must end with a semicolon.

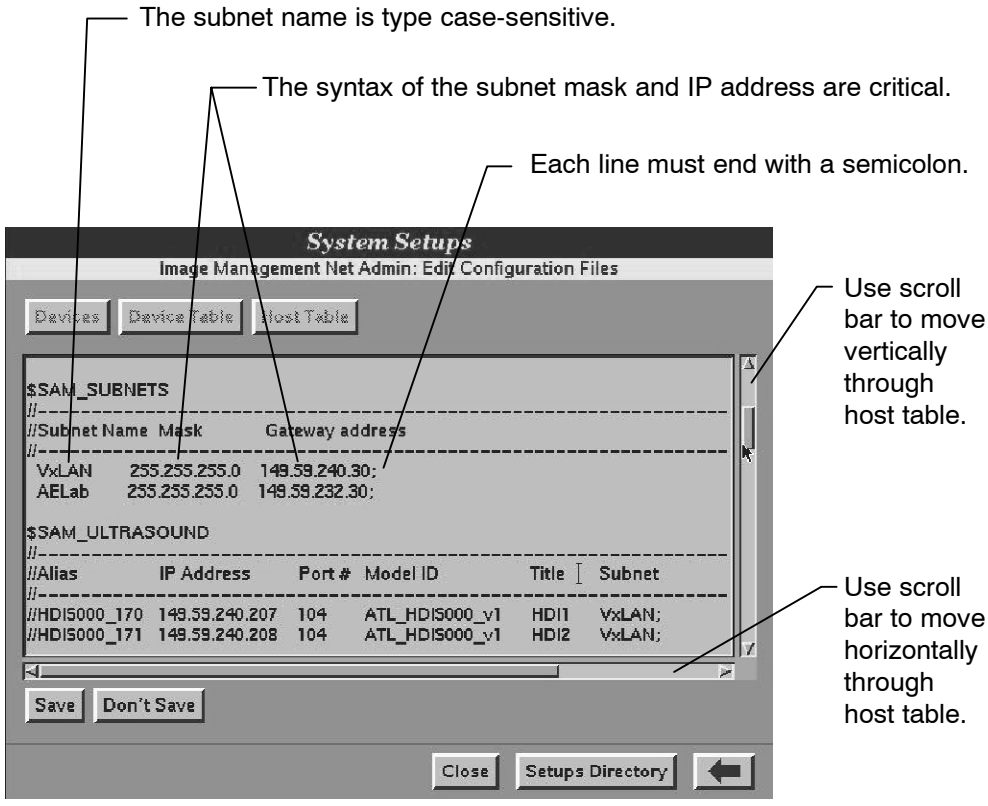

The subnet name is type case-sensitive.
The syntax of the subnet mask and IP address are critical.
Each line must end with a semicolon.
System Setups
Image Management Net Admin: Edit Configuration Files
Devices
Device Table
Host Table
$SAM_SUBNETS
//Subnet Name Mask Gateway address
VxLAN 255.255.255.0 149.59.240.30;
AELab 255.255.255.0 149.59.232.30;
$SAM_ULTRASOUND
//Alias IP Address Port # Model ID Title Subnet
//HDI5000_170 149.59.240.207 104 ATL_HDI5000_v1 HDI1 VxLAN;
//HDI5000_171 149.59.240.208 104 ATL_HDI5000_v1 HDI2 VxLAN;
Save
Don't Save
Close
Setups Directory
Use scroll bar to move vertically through host table.
Use scroll bar to move horizontally through host table.

Figure 9–26. Editing the Network Configuration Files: Subnet Area

10. Once you have entered the subnet information, use the trackball to move the cursor to the ultrasound area of the host table (Figure 9–27).
11. Press the **SELECT** control. There are examples of an ultrasound system entry entered into the host table template:
    //HDI5000_170 192.168.1.170 104 ATL_HDI5000_v1 HDI1 GenLab;
    You can delete the examples, or leave them; the // that precede the examples indicate that these lines of text are comments and, as such, are not part of the configuration files. If appropriate, you can delete the // and modify the example for your system configuration.

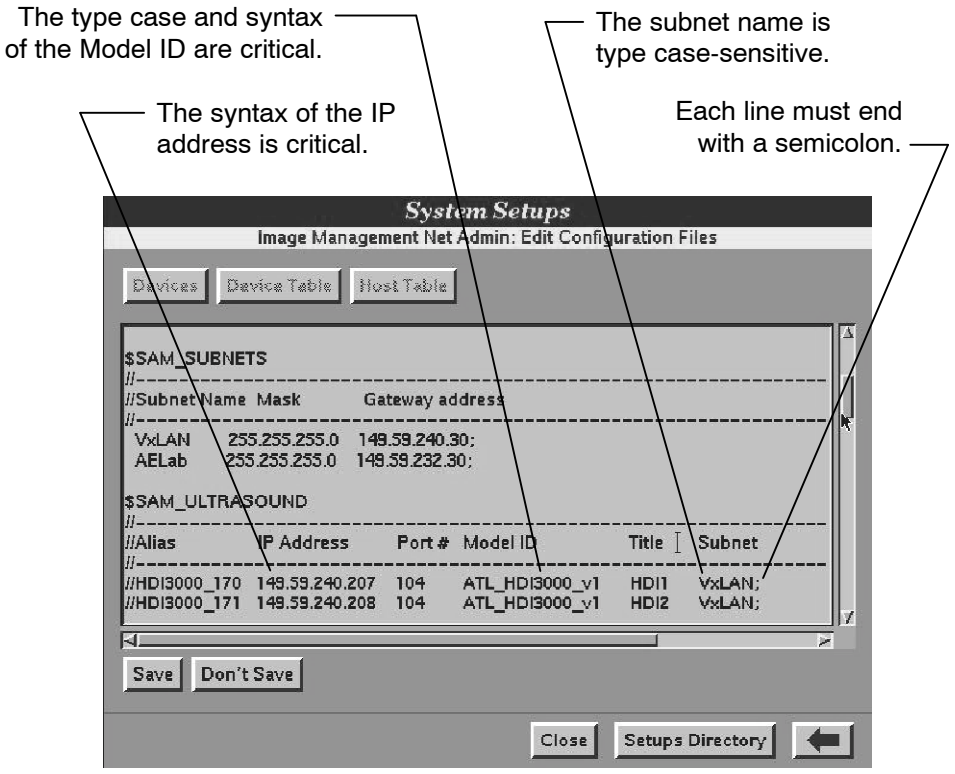

The type case and syntax of the Model ID are critical.
The subnet name is type case-sensitive.
The syntax of the IP address is critical.
Each line must end with a semicolon.
System Setups
Image Management Net Admin: Edit Configuration Files
Devices
Device Table
Host Table
$SAM_SUBNETS
//Subnet Name Mask Gateway address
VxLAN 255.255.255.0 149.59.240.30;
AELab 255.255.255.0 149.59.232.30;
$SAM_ULTRASOUND
//Alias IP Address Port # Model ID Title Subnet
//HDI3000_170 149.59.240.207 104 ATL_HDI3000_v1 HDI1 VxLAN;
//HDI3000_171 149.59.240.208 104 ATL_HDI3000_v1 HDI2 VxLAN;
Save
Don't Save
Close
Setups Directory

Figure 9–27. Editing the Network Configuration Files: Ultrasound Systems

12. Enter the alias, IP address, port #, model identification, title, and subnet for each ultrasound system on the network. Ensure that you observe the following conventions (Figure 9–27):
    - The Alias is an arbitrary name that should mean something to you. It will appear in the Image Management: Network Configuration as the Ultrasound System Net ID (Figure 9–46).
    - The IP address, which you get from your system administrator, must follow accepted rules of syntax.
    - The Port # 104 can be found in the DICOM conformance specification for the ultrasound system.
    - The Model ID can be found in the Device Table, and case and syntax must match that found in the Device Table (do not include the brackets).
    - Title is an arbitrary name that you assign as a unique identifier for an ultrasound system.
    - The Subnet Name is type case-sensitive and can be found in the Subnet area of the host table.
    - Each line of text must end with a semicolon.
13. Once you have entered the ultrasound information, use the trackball to move the cursor to the Archive area of the host table (Figure 9–28).
14. Press the **SELECT** control. There is an example of an archive entry entered into the host table template:
    //ANFS_220 192.168.1.220 104 Access_NetFileserver_v1 Destination GenLab;
    You can delete the example, or leave it; the // that precede the example indicates that this line of text is a comment, and as such, is not part of the configuration files. If appropriate, you can delete the // and modify the example for your configuration.

15. Enter the alias, IP address, port #, model identification, title, and subnet for each archive device on the network. You will need to use the horizontal scroll bar to enter the Subnet for the archive device. Ensure that you observe the following conventions (Figure 9–28):
    - The Alias is an arbitrary name that should mean something to you. It will appear in the **Image Management: Network Configuration** in the **Archive Device** list (Figure 9–46).
    - The IP address, which you get from your system administrator, must follow accepted rules of syntax.
    - The Port # can be found in the DICOM conformance specification supplied by the vendor for the archive device.
    - The Model ID can be found in the Device Table, and case and syntax must match that found in the Device Table.
    - Title is an arbitrary name that you assign as a unique identifier for the archive device.
    - The Subnet Name is type case-sensitive and can be found in the Subnet area of the host table.
    - Each line of text must end with a semicolon.

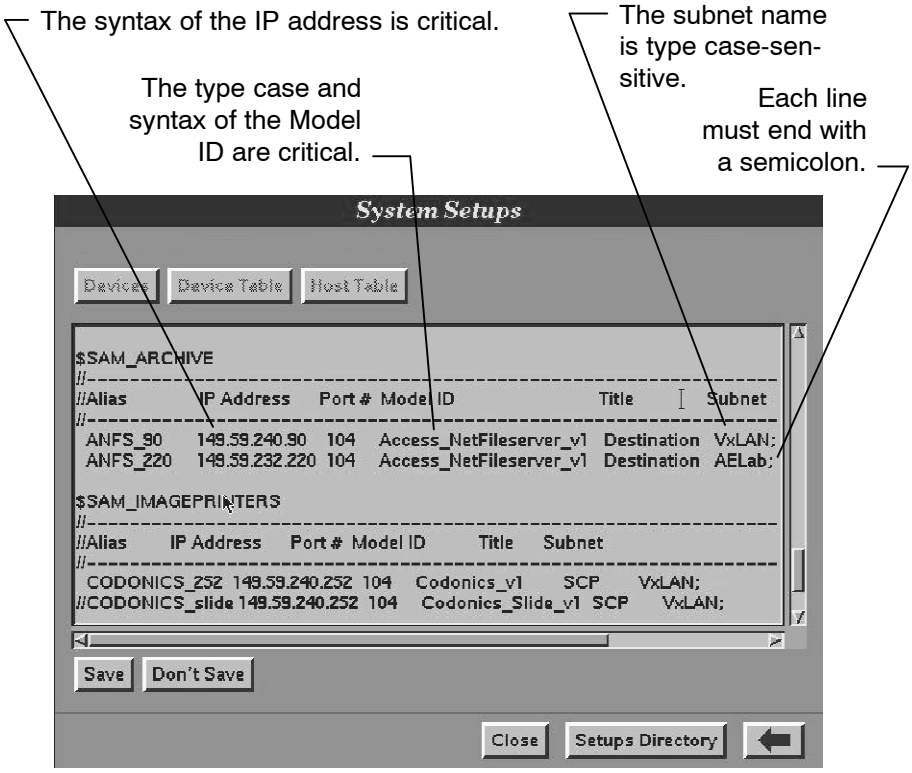

The syntax of the IP address is critical.
The type case and syntax of the Model ID are critical.
The subnet name is type case-sensitive.
Each line must end with a semicolon.
System Setups
Devices
Device Table
Host Table
$SAM_ARCHIVE
//Alias IP Address Port # Model ID Title Subnet
ANFS_90 149.59.240.90 104 Access_NetFileserver_v1 Destination VxLAN;
ANFS_220 149.59.232.220 104 Access_NetFileserver_v1 Destination AELab;
$SAM_IMAGEPRINTERS
//Alias IP Address Port # Model ID Title Subnet
CODONICS_252 149.59.240.252 104 Codonics_v1 SCP VxLAN;
//CODONICS_slide 149.59.240.252 104 Codonics_Slide_v1 SCP VxLAN;
Save
Don't Save
Close
Setups Directory

Figure 9–28. Editing the Network Configuration Files: Archive Devices

16. Once you have entered the archive device information, use the trackball to move the cursor to the Image Printers area of the host table (Figure 9–29).
17. Press the **SELECT** control. There are examples of image printer entries entered into the host table template:
    //KEMCI_230 192.168.1.230 5040 Kodak_KEMCI_V2 KEMCI GenLab;
    You can delete the examples, or leave them; the // that precede the examples indicate that these lines of text are comments, and as such, are not part of the configuration files. If appropriate, you can delete the // and modify the examples for your printer configuration.
18. Enter the alias, IP address, port #, model identification, title, and subnet for each printer on the network. Ensure that you observe the following conventions (Figure 9–29):

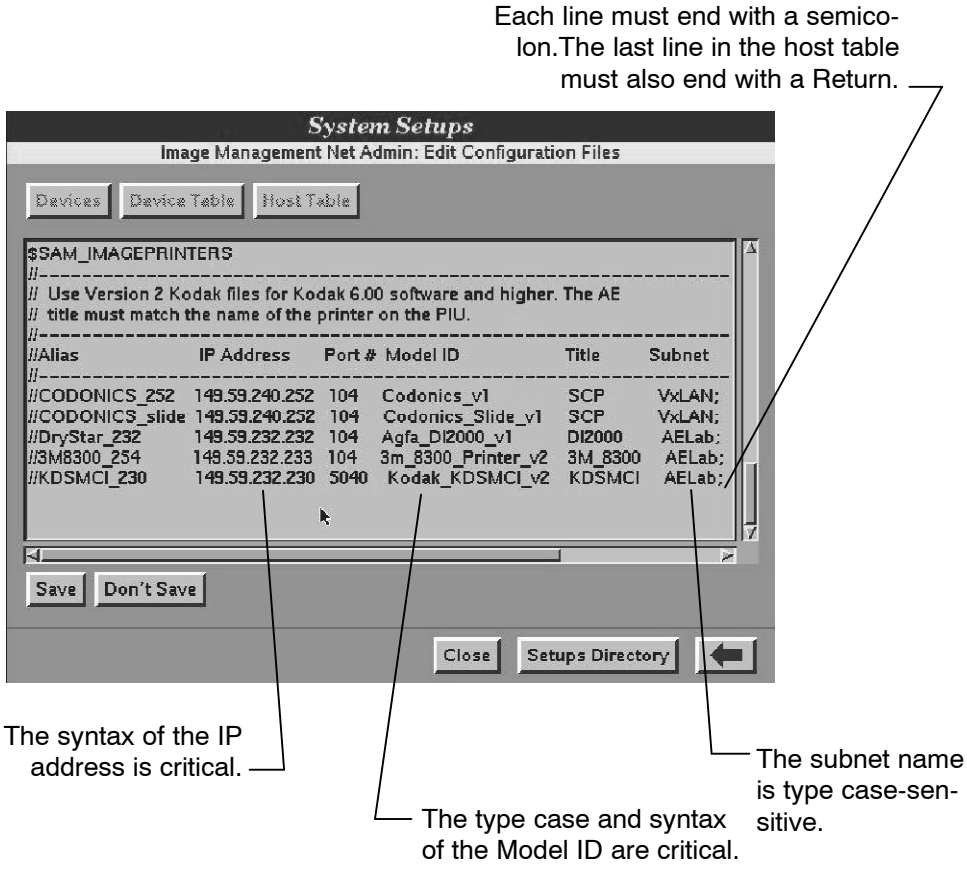

Each line must end with a semicolon.The last line in the host table must also end with a Return.
System Setups
Image Management Net Admin: Edit Configuration Files
Devices
Device Table
Host Table
$SAM_IMAGEPRINTERS
// Use Version 2 Kodak files for Kodak 6.00 software and higher. The AE
// title must match the name of the printer on the PIU.
//Alias IP Address Port # Model ID Title Subnet
//CODONICS_252 149.59.240.252 104 Codonics_v1 SCP VxLAN;
//CODONICS_slide 149.59.240.252 104 Codonics_Slide_v1 SCP VxLAN;
//DryStar_232 149.59.232.232 104 Agfa_DI2000_v1 DI2000 AELab;
//3M8300_234 149.59.232.233 104 3m_8300_Printer_v2 3M_8300 AELab;
//KDSMCI_230 149.59.232.230 5040 Kodak_KDSMCI_v2 KDSMCI AELab;
Save
Don't Save
Close
Setups Directory
The syntax of the IP address is critical.
The type case and syntax of the Model ID are critical.
The subnet name is type case-sensitive.

Figure 9–29. Editing the Network Configuration Files: Image Printers

- The Alias is an arbitrary name that should mean something to you. It will appear in the **Image Management Net Admin: B&W or Color Printers** lists. (Figure 9–30 shows the B&W Printers.)
- The IP address, which you get from your system administrator, must follow accepted rules of syntax.
- The Port # can be found in the DICOM conformance specification supplied by the vendor for the printer.
- The Model ID can be found in the Device Table, and case and syntax must match that found in the Device Table.
- Title is an arbitrary name that you assign as a unique identifier for the printer.
- The Subnet Name is type case-sensitive and is found in the Subnet area of the host table.
- Each line of text must end with a semicolon.

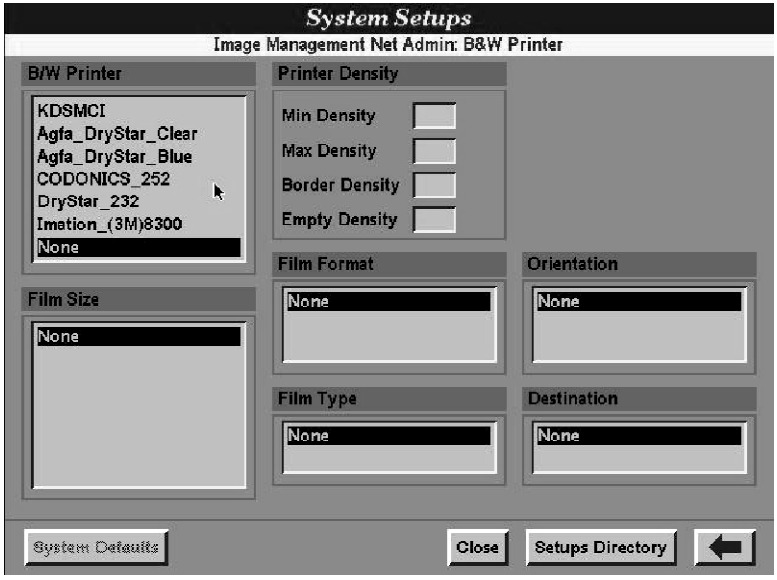


Figure 9–30. Image Management Net Admin: B & W Printers

19. Once you have entered the printers information, use the trackball to move the cursor to the worklist server area of the host table (Figure 9–29).

20. Press the **SELECT** control. There are examples of worklist server entries entered into the host table template:
    //KRATA_SERVER 149.59.254.204 24456 ATL_MWL_SCP TECHPUB SwLan1;
    You can delete the examples, or leave them; the // that precede the examples indicate that these lines of text are comments, and as such, are not part of the configuration files. If appropriate, you can delete the // and modify the examples for your printer configuration.
21. Enter the alias, IP address, port #, model identification, title, and subnet for each server on the network. Ensure that you observe the following conventions (Figure 9–29):
    - The Alias is an arbitrary name that should mean something to you. It will appear in the **Image Management Network Configuration** setups (Figure 9–21).
    - The IP address, which you get from your system administrator, must follow accepted rules of syntax.
    - The Port # can be found in the DICOM conformance specification.
    - The Model ID can be found in the Device Table, and case and syntax must match that found in the Device Table.
    - Title is an arbitrary name that you assign as a unique identifier for the server.
    - The Subnet Name is type case-sensitive and can be found in the Subnet area of the host table.
    - Each line of text must end with a semicolon.

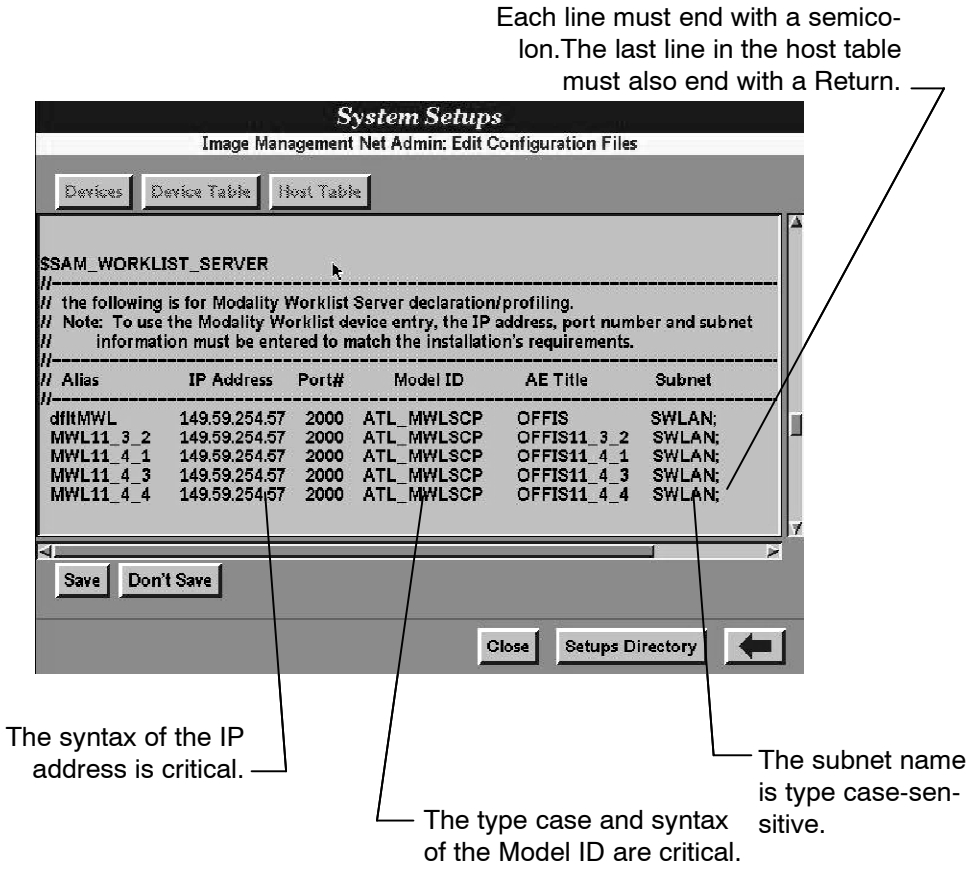

Each line must end with a semicolon.The last line in the host table must also end with a Return.
System Setups
Image Management Net Admin: Edit Configuration Files
Devices
Device Table
Host Table
$SAM_WORKLIST_SERVER
// the following is for Modality Worklist Server declaration/profiling.
// Note: To use the Modality Worklist device entry, the IP address, port number and subnet
// information must be entered to match the installation's requirements.
// Alias IP Address Port# Model ID AE Title Subnet
dfltMWL 149.59.254.57 2000 ATL_MWLSCP OFFIS SWLAN;
MWL11_3_2 149.59.254.57 2000 ATL_MWLSCP OFFIS11_3_2 SWLAN;
MWL11_4_1 149.59.254.57 2000 ATL_MWLSCP OFFIS11_4_1 SWLAN;
MWL11_4_3 149.59.254.57 2000 ATL_MWLSCP OFFIS11_4_3 SWLAN;
MWL11_4_4 149.59.254.57 2000 ATL_MWLSCP OFFIS11_4_4 SWLAN;
Save
Don't Save
Close
Setups Directory
The syntax of the IP address is critical.
The type case and syntax of the Model ID are critical.
The subnet name is type case-sensitive.

Figure 9–31. Editing the Network Configuration Files: Worklist Servers

22. Ensure the last line of the host table ends with a **Return** (following the semicolon); otherwise, the last worklist server entry will not show up in the worklist setups.
23. Once you have entered all of the information for the host table, select **Save**.
24. Select **Close**. A “Test in Progress” message appears (Figure 9–32). The configuration files will be saved; a system dialog box will appear if there is a problem. The dialog message will describe the type of problem and suggest an area that needs attention.

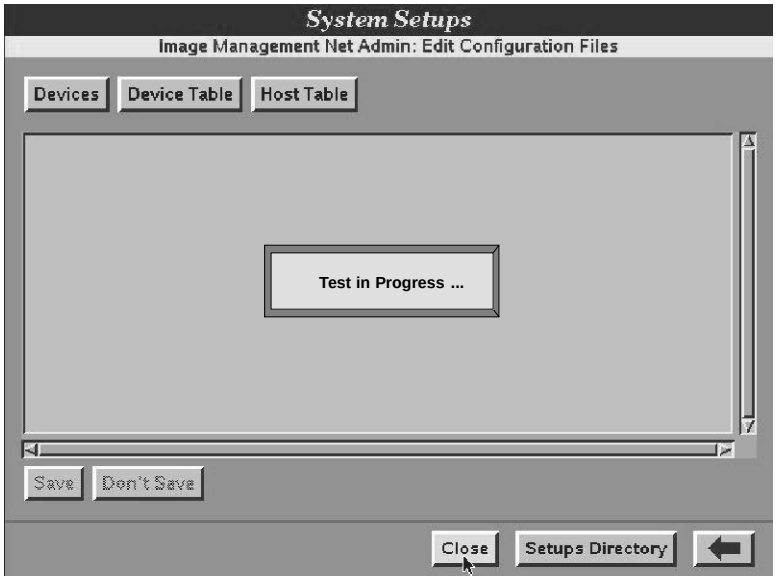


Figure 9–32. Saving the Host Table

" **To modify or transfer Network Administration configuration files:**

1. Press the **Setups** key. The **Directory of Setup Options** appears (Figure 9–18).
2. Select **Image Management**. The **Directory of Image Management Setup Options** appears (Figure 9–19).
3. Select **Configuration Files** on the **Network Administration** side of the display. The **Image Management Net Admin: Configuration Files** display appears (Figure 9–33). From this display you can do the following (procedures for these actions follow this list):
   - Make backup configuration files. If you want backup configuration files to ensure that there is an extra copy of your files on the hard disk.
   - Restore configuration files. If you are entering new configuration files and you want to use the previous version of files for some reason. This may be useful if you make a mistake creating or modifying the configuration files and need to start over with the original version.
   - Edit configuration files. If you are making a new host table, or you want to add devices to your host table. ATL recommends that you do not edit the Device files, except with the help of your Customer Service representative. The Device Table cannot be edited.

- Apply configuration files. If you have made changes to or made a new host table, Apply allows you to verify the configuration files and identify any errors.
- Copy configuration files. If you want to copy files to an optical disk for use on other ultrasound systems on the network.
- Install configuration files. Overwrites the existing host table with one on the optical disk.
- Upgrade configuration files. If you want to upgrade the files without completely installing a new version.

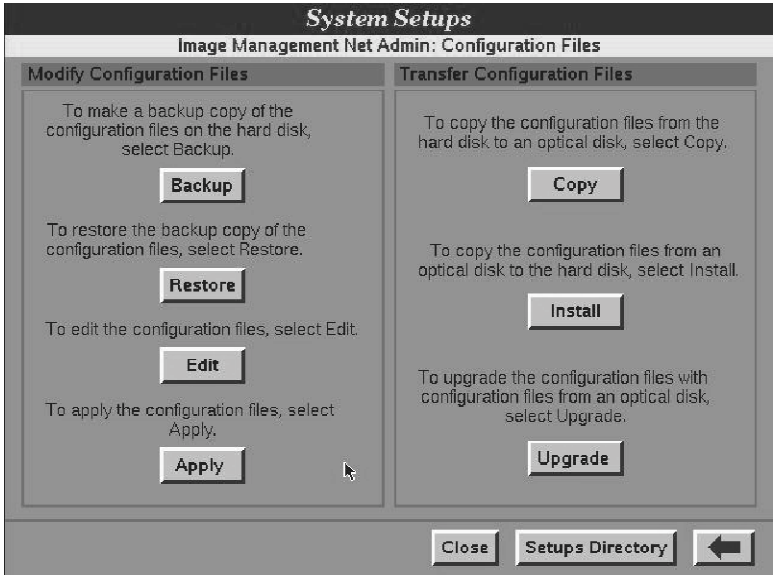

System Setups
Image Management Net Admin: Configuration Files
Modify Configuration Files
To make a backup copy of the configuration files on the hard disk, select Backup.
Backup
To restore the backup copy of the configuration files, select Restore.
Restore
To edit the configuration files, select Edit.
Edit
To apply the configuration files, select Apply.
Apply
Transfer Configuration Files
To copy the configuration files from the hard disk to an optical disk, select Copy.
Copy
To copy the configuration files from an optical disk to the hard disk, select Install.
Install
To upgrade the configuration files with configuration files from an optical disk, select Upgrade.
Upgrade
Close
Setups Directory

Figure 9–33. Network Administration: Configuration Files

" **To backup network configuration files:**

1. Display the **Image Management Net Admin: Configuration Files** setups as described in "To modify or transfer Network Administration configuration files."
2. Select **Backup**. A "Backup in progress" message appears on the screen (Figure 9–34). A backup copy of the network configuration files is created on the hard disk.

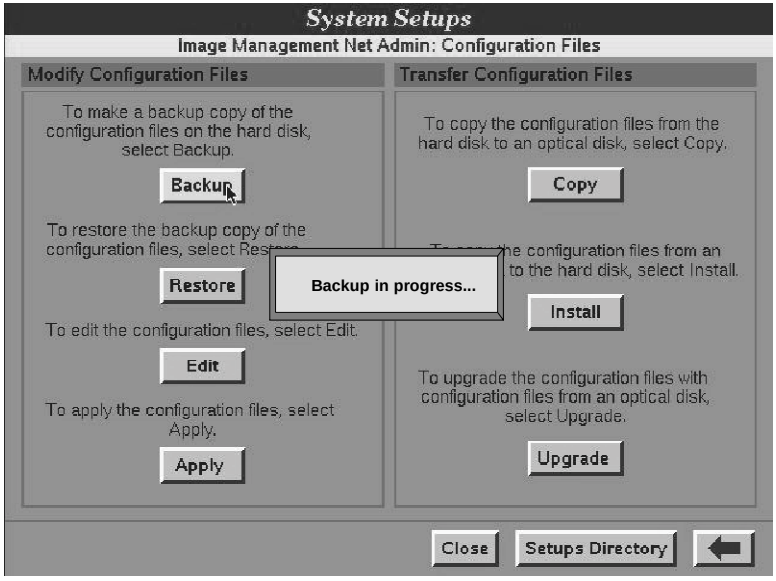

System Setups
Image Management Net Admin: Configuration Files
Modify Configuration Files
Transfer Configuration Files
To make a backup copy of the configuration files on the hard disk, select Backup.
Backup
To restore the backup copy of the configuration files, select Restore.
Restore
Backup in progress...
To edit the configuration files, select Edit.
Edit
To apply the configuration files, select Apply.
Apply
To copy the configuration files from the hard disk to an optical disk, select Copy.
Copy
to the hard disk, select Install.
Install
To upgrade the configuration files with configuration files from an optical disk, select Upgrade.
Upgrade
Close
Setups Directory

Figure 9–34. Network Configuration File Backup

" **To restore network configuration files:**

1. Display the **Image Management Net Admin: Configuration Files** setups as described in "To modify or transfer Network Administration configuration files."
2. Select **Restore**. A "Restore in progress" message appears on the screen (Figure 9–35). A backup copy of the network configuration files is restored as your configuration files.

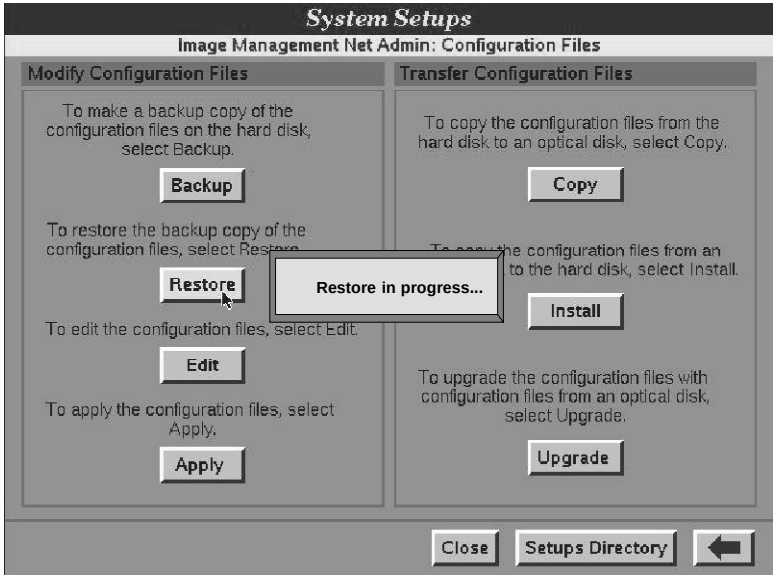

System Setups
Image Management Net Admin: Configuration Files
Modify Configuration Files
Transfer Configuration Files
To make a backup copy of the configuration files on the hard disk, select Backup.
Backup
To restore the backup copy of the configuration files, select Restore.
Restore
Restore in progress...
To edit the configuration files, select Edit.
Edit
To apply the configuration files, select Apply.
Apply
To copy the configuration files from the hard disk to an optical disk, select Copy.
Copy
to the hard disk, select Install.
Install
To upgrade the configuration files with configuration files from an optical disk, select Upgrade.
Upgrade
Close
Setups Directory

Figure 9–35. Restoring Network Configuration Files

" **To edit network configuration files:**

1. Display the **Image Management Net Admin: Configuration Files** setups as described in "To modify or transfer Network Administration configuration files."
2. Select **Edit**. The **Image Management Net Admin: Edit Configuration Files** screen appears (Figure 9–24).
3. Select **Devices**, **Device Table**, or **Host Table**. The one you select depends upon what file you want to edit.
   - ATL recommends that you do not edit the Device files. There may be an occasion when you want to change some settings in a Device file that you can not change in the setups. If this is the case, follow the instructions later in this section.

- The Device Table is not editable, but it does contain the Model ID that is necessary for the Host Table. Refer to the Device Table for the Model ID when editing or making a Host Table.
- Editing the Host Table is described in detail in "To configure your ultrasound system for NetLink operation."

" **To view or edit a Device file:**

ATL recommends that you do not edit the device files, but if you decide to do so, be aware that if the system is upgraded or new configuration files are installed, any changes that you made to the device files will be overwritten.

1. Display the **Image Management Net Admin: Configuration Files** setups as described in "To modify or transfer Network Administration configuration files."
2. Select **Edit**. The **Image Management Net Admin: Edit Configuration Files** display appears.
3. Select **Devices**. The directories and device files appear (Figure 9–36).

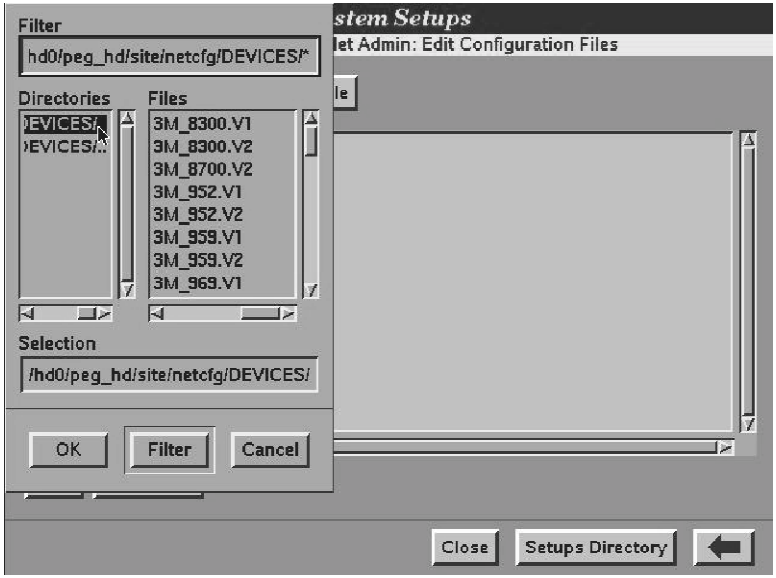


Figure 9–36. Device Files

4. Select the file that you want to view or edit. (You can use the scroll bar to scroll down through the files.) The file appears in the **Selection** window (Figure 9–37).

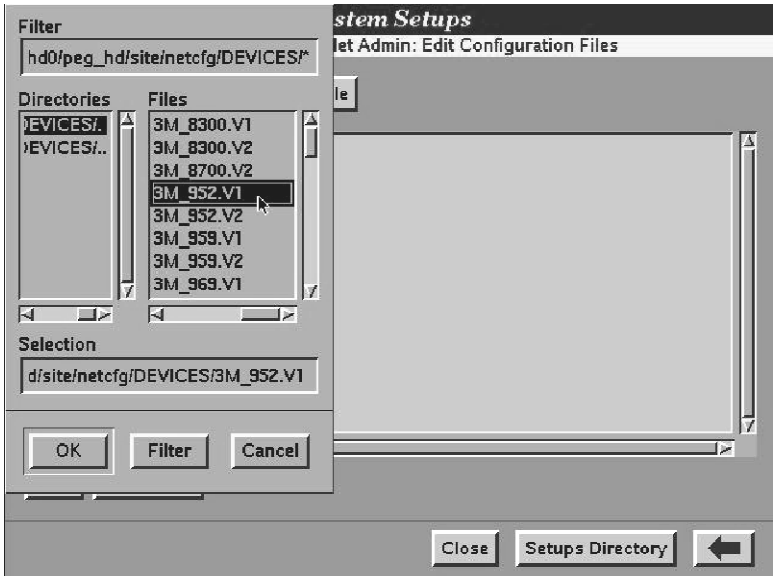


Figure 9–37. File Selection

5. Select **OK**. The Device file is displayed (Figure 9–38), and you can scroll down through the file to view or edit the device file. (ATL recommends that you do not edit these files.)

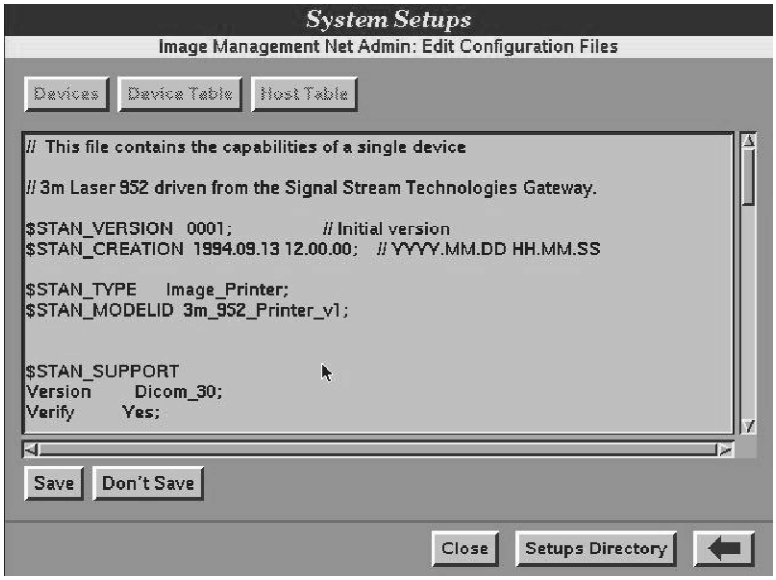


Figure 9–38. Device File (Example)

" **To view the Device Table:**

You cannot edit the Device Table. You view the information in the Device Table, for example, to determine the correct Model ID for the ultrasound systems and devices.

1. Display the **Image Management Net Admin: Configuration Files** setups as described in "To modify or transfer Network Administration configuration files."
2. Select **Edit**. The **Image Management Net Admin: Edit Configuration Files** display appears.
3. Select **Device Table**. The **Device Table** appears (Figure 9–39).
4. Scroll through the **Device Table**. The **Device Table** contains the Model ID, which you use when you make your host table (Figure 9–39).

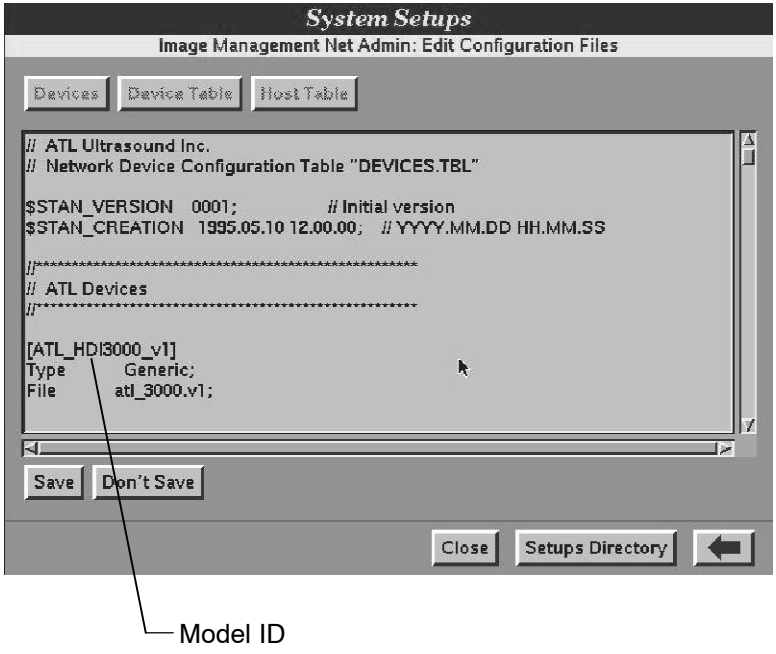


Figure 9–39. Device Table: Model ID

" **To apply new or edited network configuration files:**

1. Display the **Image Management Net Admin: Configuration Files** setups as described in "To modify or transfer Network Administration configuration files."
2. Select **Apply**. A "Test in progress" message appears on the screen (Figure 9–40). The configuration files are applied.

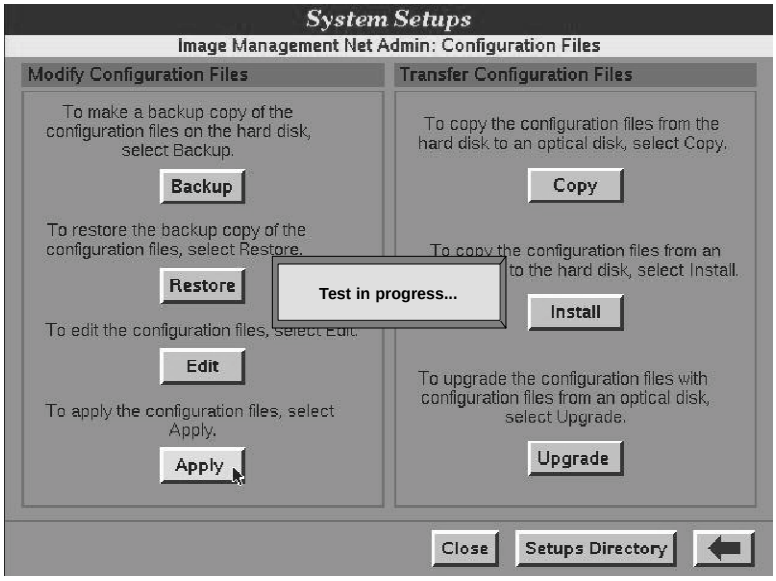

System Setups
Image Management Net Admin: Configuration Files
Modify Configuration Files
To make a backup copy of the configuration files on the hard disk, select Backup.
Backup
To restore the backup copy of the configuration files, select Restore.
Restore
To edit the configuration files, select Edit.
Edit
To apply the configuration files, select Apply.
Apply
Transfer Configuration Files
To copy the configuration files from the hard disk to an optical disk, select Copy.
Copy
Test in progress...
Install
To upgrade the configuration files with configuration files from an optical disk, select Upgrade.
Upgrade
Close
Setups Directory

Figure 9–40. Applying Network Configuration Files

" **To copy network configuration files:**

1. Display the **Image Management Net Admin: Configuration Files** setups as described in "To modify or transfer Network Administration configuration files."
2. Install a formatted optical disk into the system optical disk drive.
3. Select **Copy**. A "Copy in progress" message appears on the screen (Figure 9–41). The configuration files are copied from hard disk to optical disk.

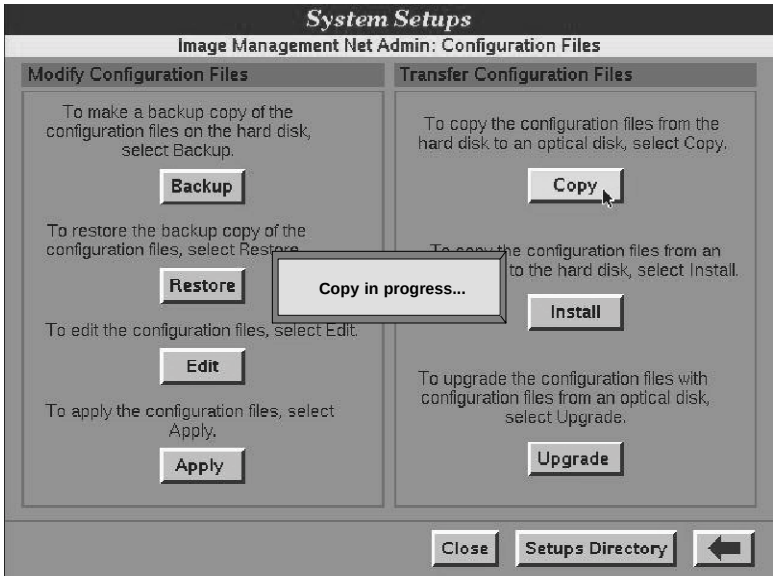

System Setups
Image Management Net Admin: Configuration Files
Modify Configuration Files
To make a backup copy of the configuration files on the hard disk, select Backup.
Backup
To restore the backup copy of the configuration files, select Restore.
Restore
To edit the configuration files, select Edit.
Edit
To apply the configuration files, select Apply.
Apply
Transfer Configuration Files
To copy the configuration files from the hard disk to an optical disk, select Copy.
Copy
Copy in progress...
to the hard disk, select Install.
Install
To upgrade the configuration files with configuration files from an optical disk, select Upgrade.
Upgrade
Close
Setups Directory

Figure 9–41. Copying Network Configuration Files

" **To install network configuration files:**

1. Display the **Image Management Network Administration** setups as described in "To modify or transfer Network Administration configuration files."
2. Install an optical disk with network configuration files into the system optical disk drive.
3. Select **Install**. A dialog box appears (Figure 9–42). If you want to overwrite the current configuration files, and continue with the installation, then select **Overwrite**. If you want to cancel the install, then select **Cancel**.

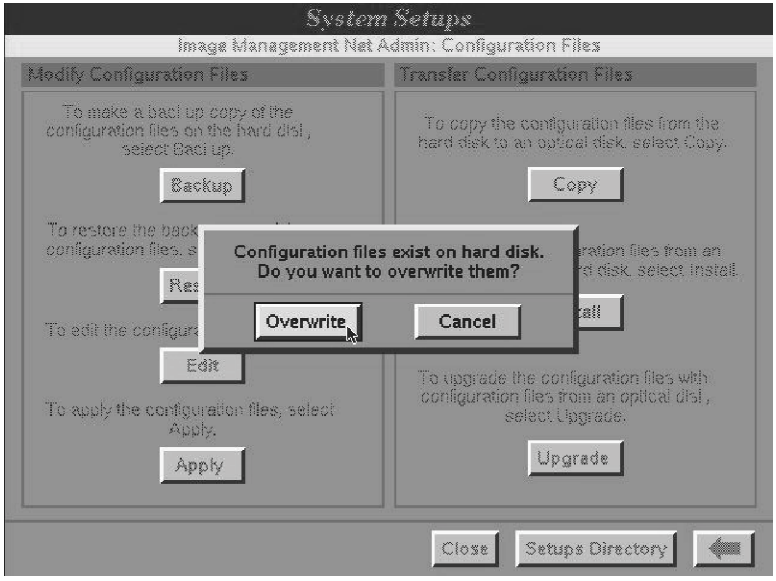

System Setups
Image Management Net Admin: Configuration Files
Modify Configuration Files
Transfer Configuration Files
To make a back up copy of the configuration files on the hard disk, select Back up.
Backup
To copy the configuration files from the hard disk to an optical disk, select Copy.
Copy
Configuration files exist on hard disk.
Do you want to overwrite them?
Overwrite
Cancel
Edit
To apply the configuration files, select Apply.
Apply
To upgrade the configuration files with configuration files from an optical disk, select Upgrade.
Upgrade
Close
Setups Directory

Figure 9–42. Installing Network Configuration Files: Overwrite or Cancel

4. If you selected **Overwrite** in the previous step, then an “Install in progress” message appears on the screen (Figure 9–43). The configuration files on the optical disk overwrite the configuration files that were on the hard disk.

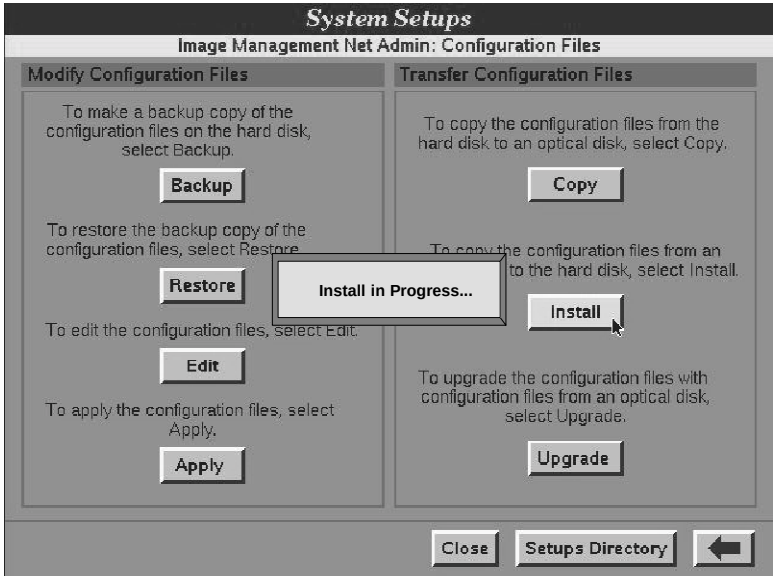

System Setups
Image Management Net Admin: Configuration Files
Modify Configuration Files
To make a backup copy of the configuration files on the hard disk, select Backup.
Backup
To restore the backup copy of the configuration files, select Restore.
Restore
To edit the configuration files, select Edit.
Edit
To apply the configuration files, select Apply.
Apply
Transfer Configuration Files
To copy the configuration files from the hard disk to an optical disk, select Copy.
Copy
Install in Progress...
Install
To upgrade the configuration files with configuration files from an optical disk, select Upgrade.
Upgrade
Close
Setups Directory

Figure 9–43. Installing Network Configuration Files

" **To upgrade the network configuration files:**

1. Display the **Image Management Net Admin: Configuration Files** setups as described in "To modify or transfer Network Administration configuration files."
2. Install an upgrade optical disk into the system optical disk drive.
3. Select **Upgrade**. An **Upgrade** dialog box appears (Figure 9–44).

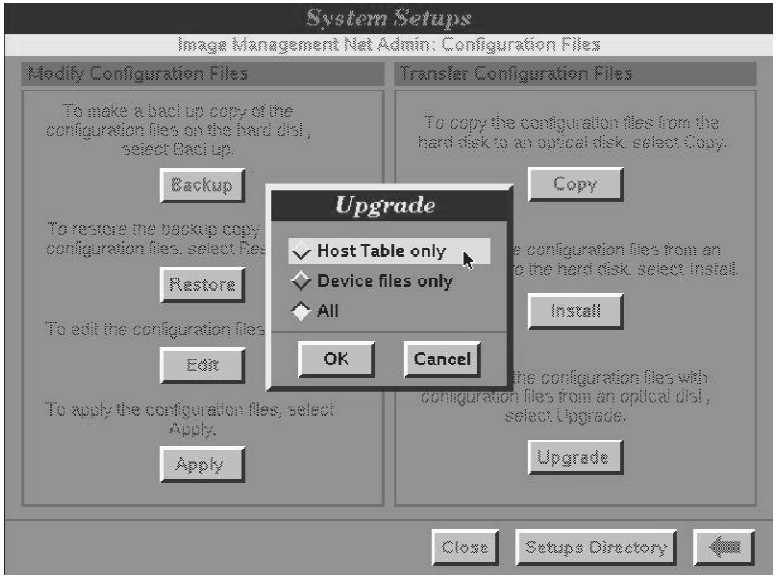


Figure 9–44. Upgrade Dialog Box

4. Select **Host Table only**, **Device files only**, or **All**. The one you select depends upon the scope of the upgrade.
5. Select **OK** to complete the upgrade, or **Cancel** to stop the upgrade operation. An "Upgrade in progress" message appears on the screen (Figure 9–45). The configuration files are upgraded.

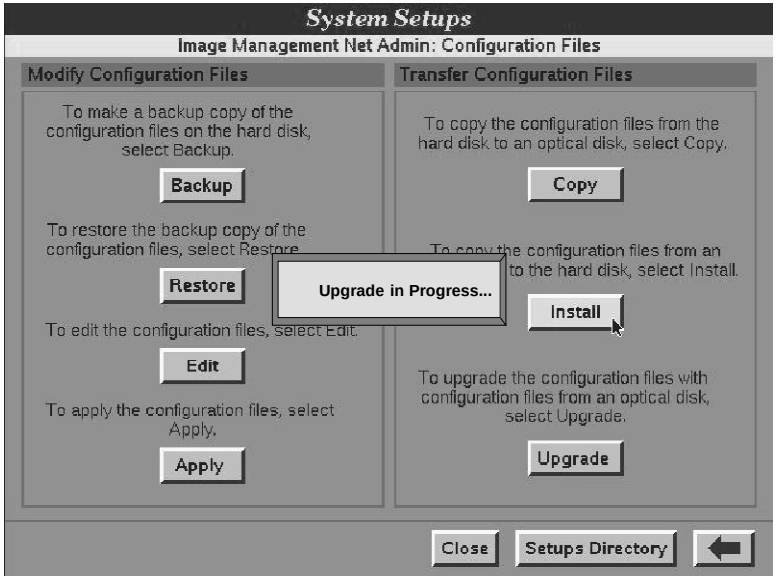

System Setups
Image Management Net Admin: Configuration Files
Modify Configuration Files
To make a backup copy of the configuration files on the hard disk, select Backup.
Backup
To restore the backup copy of the configuration files, select Restore.
Restore
To edit the configuration files, select Edit.
Edit
To apply the configuration files, select Apply.
Apply
Transfer Configuration Files
To copy the configuration files from the hard disk to an optical disk, select Copy.
Copy
to the hard disk, select Install.
Install
To upgrade the configuration files with configuration files from an optical disk, select Upgrade.
Upgrade
Upgrade in Progress...
Close
Setups Directory

Figure 9–45. Upgrade Message

" **To verify your ultrasound system network identification:**

Your ultrasound system network ID, which you specified in your host table, is selected for you in the **Network Configuration** setups. The following procedure describes how you verify or change your configuration. You should also verify these relationships when you configure your system for network operations.

1. Press the **Setups** key. The **Directory of Setup Options** appears (Figure 9–18).
2. Select **Image Management**. The **Directory of Image Management Setup Options** appears (Figure 9–22).
3. Select **Network Configuration**. The **Image Management: Network Configuration** setups are displayed (Figure 9–46).

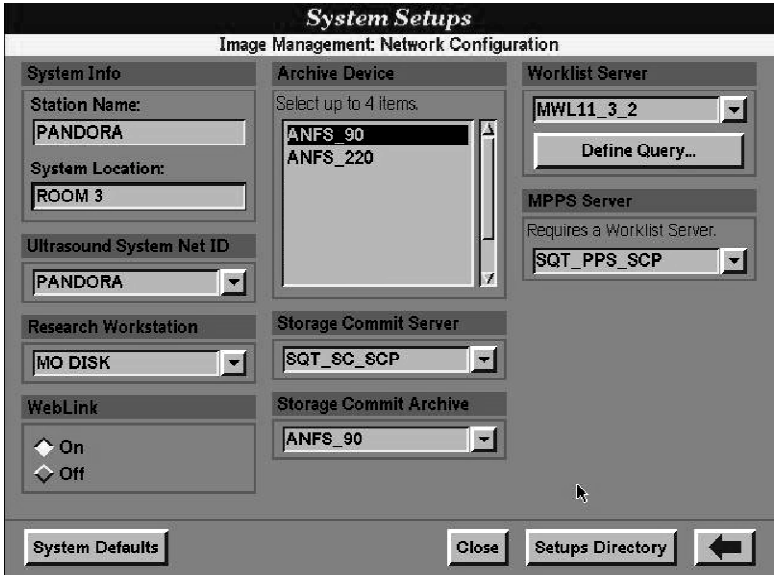


Figure 9–46. Image Management: Network Configuration

4. Verify the **Net ID** of the ultrasound system.
5. If you want to change the **Net ID**, select a different **Net ID** from the list. The system displays a dialog box (Figure 9–47).
6. Select **Change Net ID**. The system displays a message that directs you to reboot (Figure 9–48).

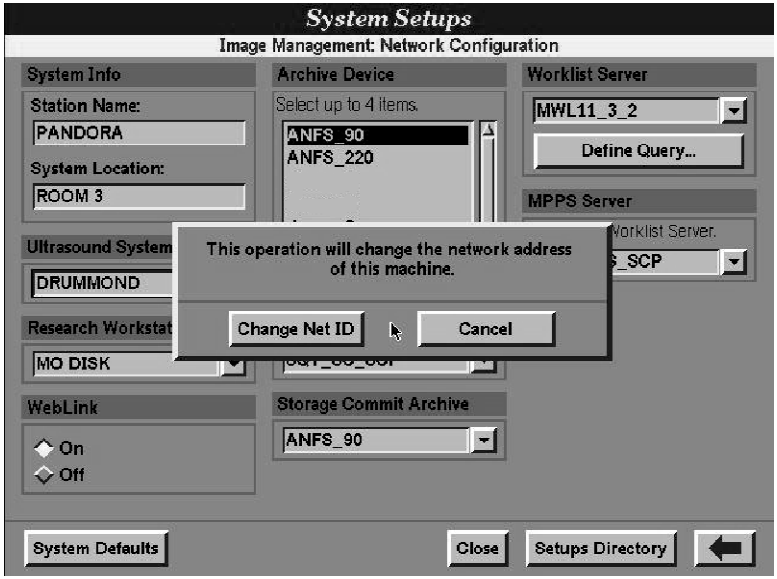


Figure 9–47. Changing the Net ID

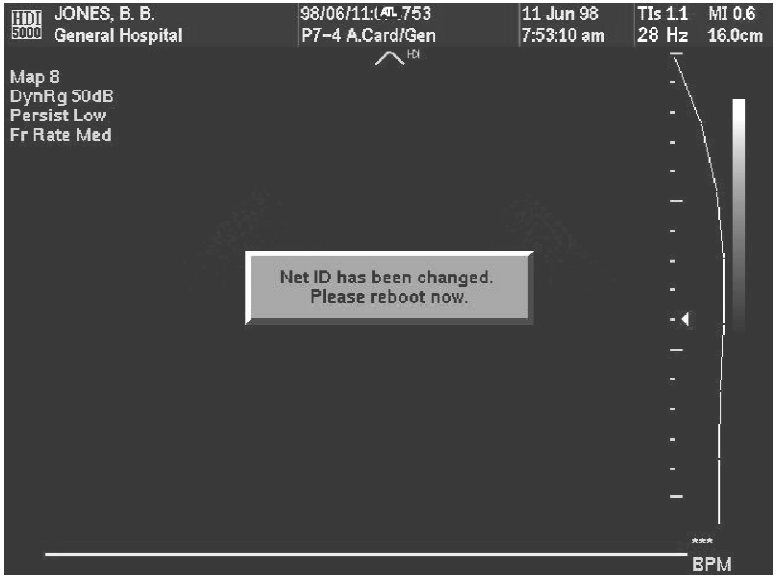


Figure 9–48. Completing the Net ID Change

" **To verify your archive devices:**

1. Press the **Setups** key. The **Directory of Setup Options** appears (Figure 9–18).
2. Select **Image Management**. The **Directory of Image Management Setup Options** appears (Figure 9–19).
3. Select **Network Configuration**. The **Image Management: Network Configuration** setups appear.
4. Depending upon the archive devices available, select no more than four of them in the **Archive Devices** list. The archive devices are set up for use (Figure 9–46).

" **To change the 3D image storage destination:**

1. Press **Setups**. The **Directory of Setup Options** appears (Figure 9–18).
2. Select **Image Management**. The **Directory of Image Management Setup Options** appears (Figure 9–19).
3. Select **Network Configuration**. **Image Management: Network Configuration** setups appear (Figure 9–49).

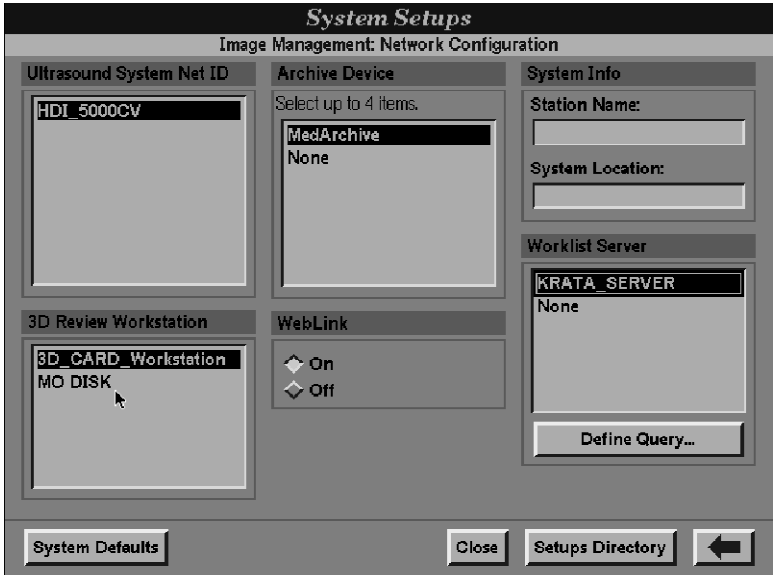


Figure 9–49. Image Transfer Setups

4. A list of selections specific to your site are available under **3D Review Workstation**. The items listed under **3D Review Workstation** are determined when the system is configured for your network. Highlight your choice as the destination for image transfers. Figure 9–49 displays two common choices:
   - **MO DISK** is highlighted to store images to a formatted optical disk, when your system has the optical disk drive option.
   - **3D CARD Workstation** is highlighted to store images directly to a workstation over the network. You may have several workstations from which to select, each with a unique name.
5. Select **Close** or press the **Setups** key to save your selection and exit setups.

" **To check network status:**

1. Press the **NET/DISK MENU** control. The **Net/Disk** menu appears (Figure 9–50).

Figure 9–50. Net/Disk Menu

2. Select **Status**. The **Network Status** display appears (Figure 9–51).

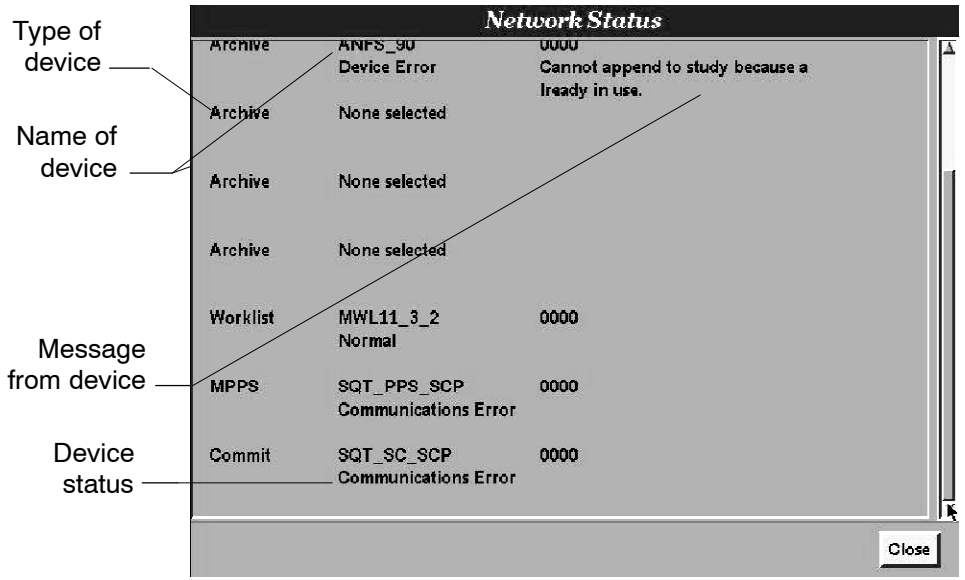


Figure 9–51. Network Status

WebLink Setup

WebLink capability operation requires that the Web server, which is internal to the system, be enabled and then the system configured or set up accordingly. Your customer support representative enables the Web server. You set up your system and use the WebLink feature operations as described below.

" **To set up your system for WebLink capability operation:**

1. Press the **Setups** key. The **Directory of Setup Options** appears (Figure 9–18).
2. Select **Image Management**. The **Directory of Image Management Setup Options** appears (Figure 9–19).
3. Select **Network Configuration**. The **Image Management: Network Configuration** setups appear (Figure 9–52).
4. Verify that the alias for your ultrasound sytem appears in the **Ultrasound System Net ID** list. If it does not appear here, then perform steps 10 through 12 in "To configure your ultrasound system for NetLink operation," earlier in this section, to add it to the host table.

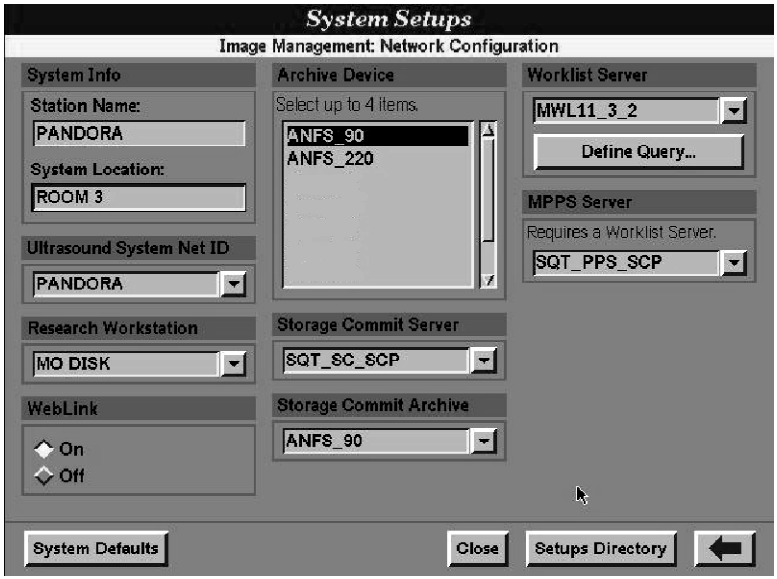


Figure 9–52. Image Management: Network Configuration

5. Select **On** to turn WebLink on. The system is set up for WebLink operation.

Worklist System Setup

Changes in your work schedule or operating procedures might require changes to the ultrasound system **Worklist** setups. Your objective for **Worklist** setups is to have the system download the worklist at the time you want it and from the source (server) that has the list you need. Once the ultrasound system is configured, it will remain that way through power cycles until you reconfigure it.

" **To select a Worklist server:**

1. Press **Setups**. The **Directory of Setup Options** appears.
2. Select **Image Management**. The **Directory of Image Management Setup Options** appears.
3. Select **Network Configuration**. The **Image Management: Network Configuration** is displayed (Figure 9–53). The selections under **System Info** are used to configure the ultrasound system for the Worklist feature.

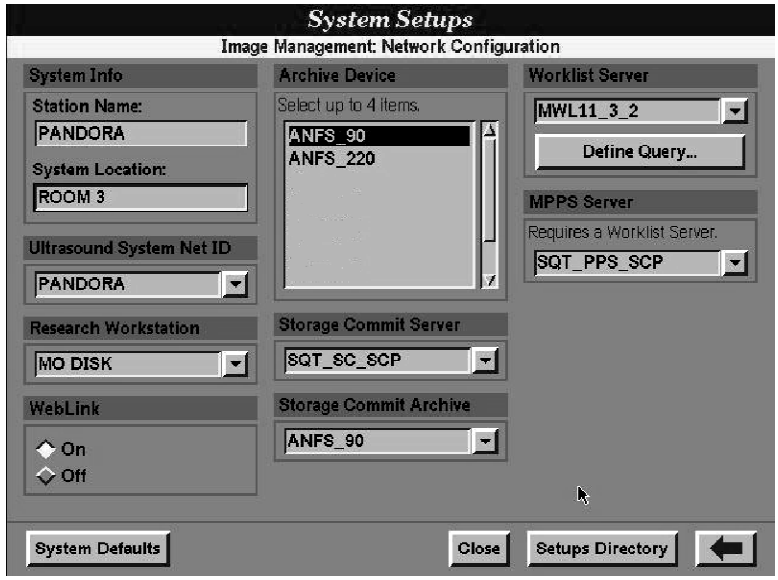


Figure 9–53. Image Management: Network Configuration

4. Select the desired server in the list under **Worklist Server**. Servers listed here are set up by your system administrator as part of the local network configuration.
5. The **Station Name** and **System Location** data fields are set up to filter the worklist as specified by the system administrator and should not be changed without specific directions from the administrator. These fields are determined when the system is set up for a site–specific configuration.
6. Select **Close** or press **Setups**. The server will transfer worklists.

Note *Selecting **None** under **Worklist Server** will disable the Worklist feature, and the system will operate as though it did not have the feature.*

" **To define the Worklist update criteria:**

1. Press **Setups**. The **Directory of Setup Options** appears.
2. Select **Image Management**. The **Directory of Image Management Setup Options** appears.
3. Select **Network Configuration**. The **Image Management: Network Configuration** appears.
4. Select **Define Query**. The **Define Query** dialog appears (Figure 9–54).

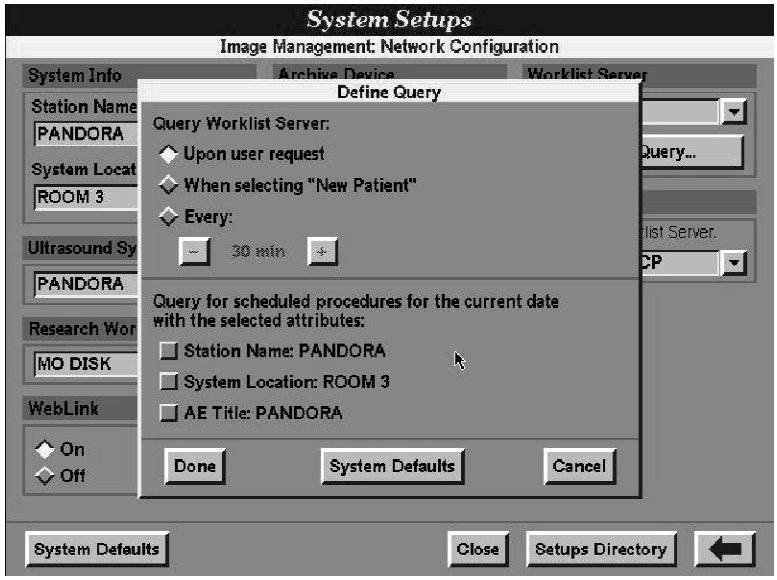


Figure 9–54. Define Query

5. Select the appropriate choice under **Query Worklist Server**:
   - **Upon user request** sets the system to update the worklist each time **Update List** on the **Patient Data Entry** form is selected.
   - **When selecting "New Patient"** sets the system to update each time a new patient is entered.
   - **Every** sets the system to update the worklist according to a time interval. Use **+** and **–** to set the time interval between 15 and 120 minutes. The system will automatically call the server to update the worklist at the time interval set.
6. Select **Station Name**, **System Location**, and **AE Title** as required for your Worklist server. These are optional filtering attributes for your system. These data fields are determined at installation. Consult your system administrator.

" **To set up the Modality Performed Procedure Step (MPPS) server:**

For scheduled patient exams from a worklist, the MPPS feature allows you to discontinue a patient exam. The MPPS feature provides for the transfer of information about the exam to a DICOM MPPS server. After an exam is completed, the MPPS feature sends information to the MPPS server indicating that the exam was completed. If an exam cannot be successfully completed, then you can discontinue the procedure. To discontinue the procedure, you select **Discontinue** on the **Patient Data Entry** form. An MPPS discontinue status is attached to the electronic patient file. The clinical information system (CIS) or the billing server can then handle this type of procedure differently than a patient exam that is completed normally.

Your system administrator must configure the system host table with an MPPS server. The **Image Management: Network Configuration** setups will then contain an **MPPS Server** setup, which must be enabled to allow use of the MPPS feature with the worklist.

1. Press the **Setups** key. The **Directory of Setup Options** appears (Figure 9–18).
2. Select **Image Management**. The **Directory of Image Management Setup Options** appears (Figure 9–22).
3. Select **Network Configuration**. The **Image Management: Network Configuration** setups are displayed (Figure 9–46).
4. Select a worklist server (Figure 9–55). A worklist server is necessary for the MPPS feature to work.

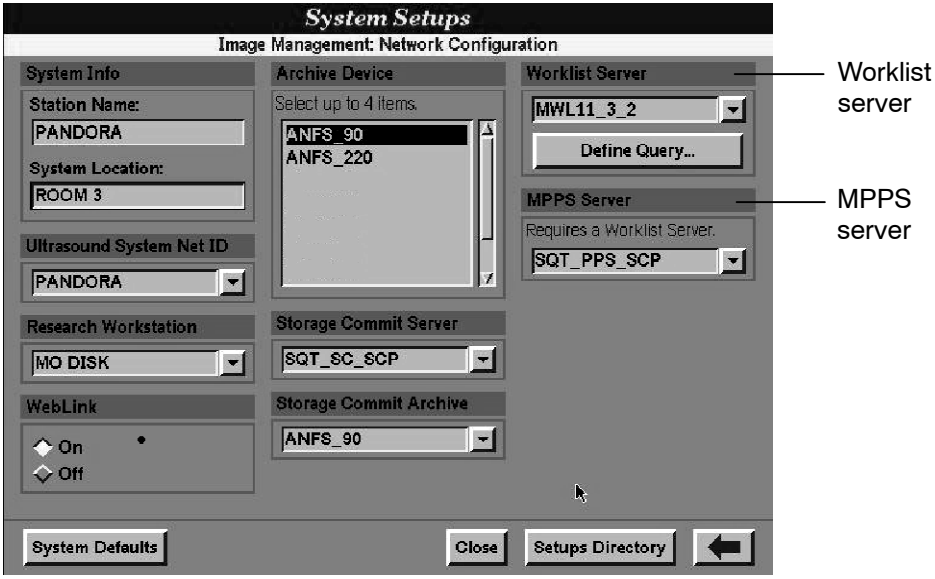


Figure 9–55. MPPS Server Configuration

5. Select the MPPS server (Figure 9–55)**.** The alias of the MPPS server appears in the **MPPS Server** field.
6. Press the **SELECT** control to enable the MPPS server.
7. Select **Close** to return to imaging.
8. Press the **Patient Data** key. The **Patient Data Entry** form appears with the **Discontinue** selection (Figure 9–57).

" **To setup the DICOM Storage Commit (SC) feature:**

For scheduled patient exams from a worklist, the DICOM SC feature allows you to archive images to a network server and to receive a response from the server, indicating it has received the storage request and successfully stored the images. The system sends Storage Commit requests to the SC server when all images from an exam have been sent to the target archive device and either a new exam has begun or **Discontinue** on the **Patient Data Entry** form has been selected. You can observe the status of a Storage Commit request in the **Hard Disk Exam Directory**. If the **Commit** column status is **yes**, the images were successfully stored on the network archive device.

Your system administrator must configure the system host table with an SC server. The **Image Management: Network Configuration** setups will then contain **Storage Commit Server** and S**torage Commit Archive** setups. Your system administrator selects which archive device will serve as the Storage Commit server.

1. Press the **Setups** key. The **Directory of Setup Options** appears (Figure 9–18).
2. Select **Image Management**. The **Directory of Image Management Setup Options** appears (Figure 9–22).
3. Select **Network Configuration**. The **Image Management: Network Configuration** setups are displayed (Figure 9–46).
4. Select a worklist server (Figure 9–56). A worklist server is necessary for the Storage Commit feature to work.

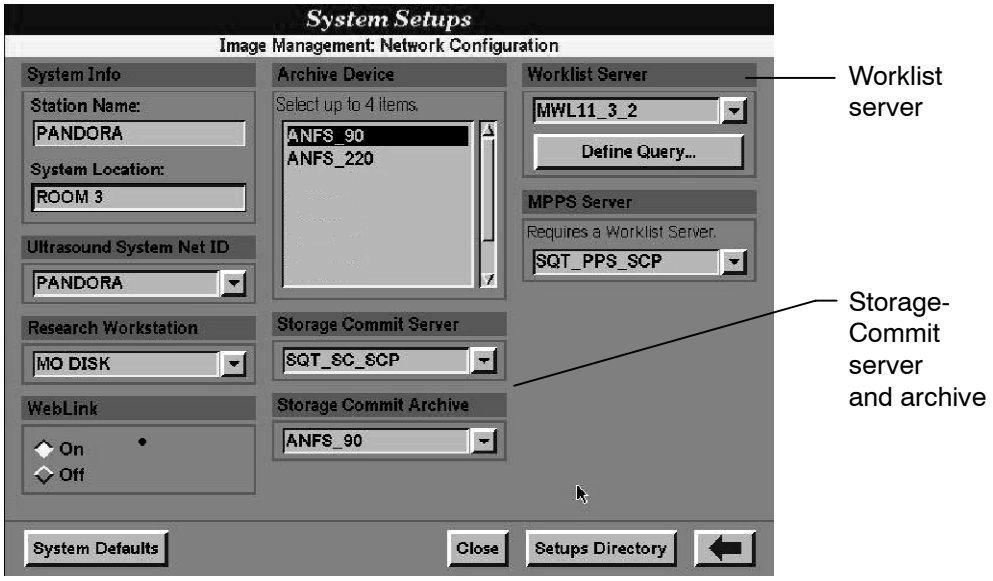


Figure 9–56. Storage Commit Server Configuration

5. Select at least one archive device from the **Archive Device** list.
6. Select the **Storage Commit Archive** drop-down menu. The SC archive devices are listed.
7. Select the **Storage Commit Archive** device.
8. Select the **Storage Commit Server** drop-down menu. The Storage Commit servers are listed.
9. Select the **Storage Commit Server** to which you want the exams to be archived. In the **Exam Directory: Hard Disk**, you can check the **Sent/Commit** status of each exam to verify that your images arrived at the selected device.
10. Select **Close** to return to imaging.

Operating Instructions

Starting an Exam

Starting an exam begins with entering patient data. When you enter patient data, an electronic file is created for the patient. Any images that you store for that patient are identified by the patient data and included in that patient's file. If you do not enter an ID for a patient, the system will automatically assign an ID for the patient.

For systems with the NetLink option installed, an optional 16-character accession number may be entered into a field provided on the **Patient Data Entry** form. The accession number is used in some institutions to track patient exams in their information management system.

Also included in this section is information on installing an optical disk, formatting an optical disk, and getting optical-disk and hard-disk capacity.

Patient Data

Exams begin by entering patient information into patient data forms. With the Worklist feature, patient data is entered automatically by selecting a patient from the worklist. The worklist is compiled prior to the exam day and includes patient information, identifiers, and study data. The list is periodically updated and sent over a network to reside on the ultrasound system for access during an exam. Two conditions must be met to be able to update the worklist:

- The Worklist server and ultrasound system are configured and communicating over the network.
- The Worklist server has a "worklist" to transfer to the ultrasound system.

The worklist is located on the **Patient Data Entry** form, which also includes data entry fields and worklist-specific selections (Figure 9–57):

- **Discontinue** can be selected when you want to end an exam that was not completed. This selection is available for the DICOM Modality Performed Procedure Step (MPPS) and the Storage Commit (SC) feature.
- **Patient Search** is used to display the **Patient Search** form, which lets you define items you wish to retrieve from the Worklist server.
- **Update List** is used to tell the Worklist server to send an updated list to ultrasound system memory. Selecting this causes the Worklist server to send the most current version of the patient worklist as defined by the network and ultrasound system configuration.
- **Find** is a data entry field used for typing in search criteria for the worklists. It is useful when lists residing on the ultrasound system are large. The entry you type in is brought into view on the work-list.

- **Sorted by** indicates the column by which the list is sorted, the column marked with an asterisk. You can change the **sorted by** column by selecting another column header: **Time/Date**, **Patient Name**, **ID**, **Accession**, or **Exam Type**.

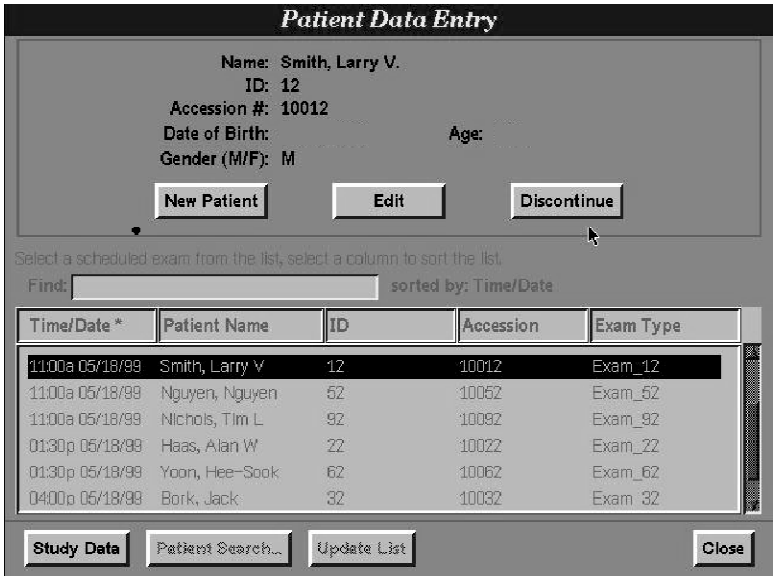


Figure 9–57. Patient Data Entry Form With the Worklist

" **To enter new patient data with the Worklist feature:**

1. Press the **Patient Data** key. The **Patient Data Entry** form, with the list of patients appears. (If no list appears, select **New Patient** to update your worklist).
2. Select **New Patient**. A message, “Ending previous exam,” appears, and the list turns black.
3. Press the **Patient Data** key when you are satisfied with your selection. The display will return to imaging and the Patient’s name appears at the top of the display.

Note *When a new patient is selected from the worklist, patient data appears in the form. The exam starts when the first image is stored. The exam ends when a new patient is selected,* ***Discontinue*** *is selected, system power is turned off, or selection of another patient in review.*

" **To edit patient data with the Worklist feature:**

1. Press the **Patient Data** key. The **Patient Data Entry** form appears.
2. Select **Edit**. The **Edit Patient** form appears (Figure 9–58).

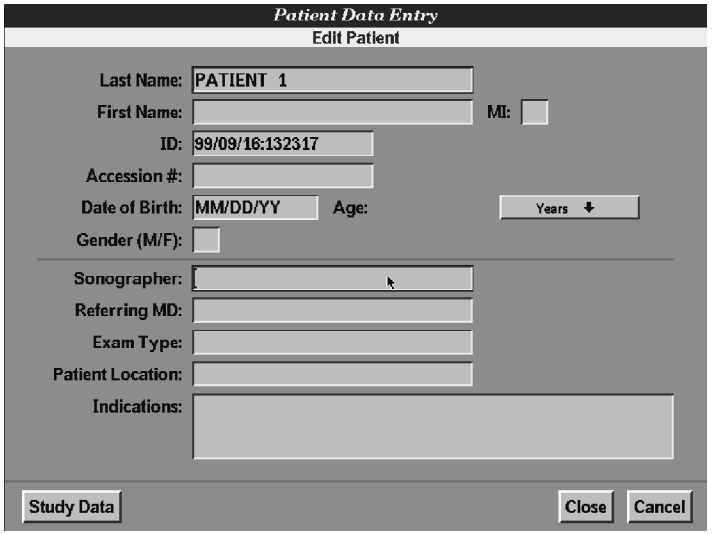


Figure 9–58. Edit Patient Data

3. Use the keyboard edit patient information. Press return after each entry. Only fields that are not grayed out can be edited.
4. Press the **Patient Data** key, or select **Close** to save the entered information and to exit the display. To exit the display without saving changes, select **Cancel**.

" **To view or modify study data:**

1. Press the **Patient Data** key. The **Patient Data Entry** form appears.
2. Select **Study Data**. The **Study Data** form is displayed (Figure 9–59). To return to the previous display, with the worklist, select **Study Data** again. To modify the data, proceed with step 3.

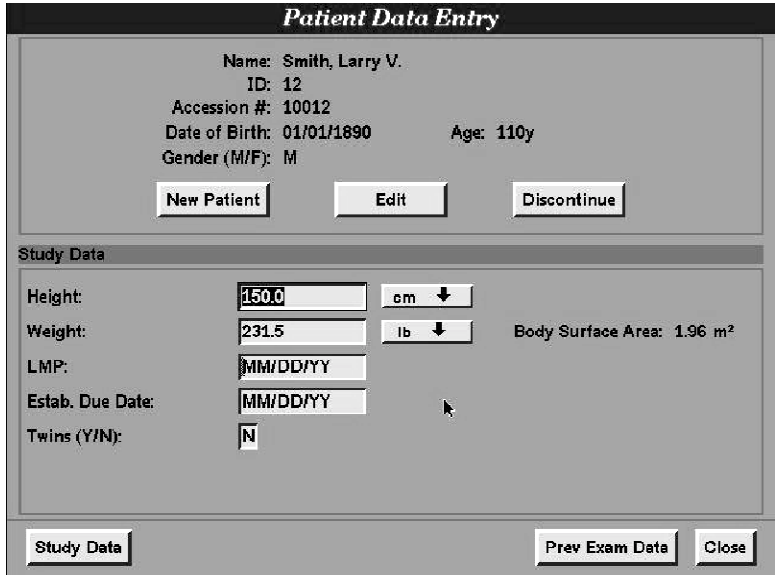


Figure 9–59. Study Data Form

3. If necessary, change the units of measure on the **Study Data** form:
   a. Use the trackball to move the cursor to the units of measure and press **SELECT**.
   b. Select the units of measure**.** Units of measure include the following: for height, cm (centimeters) or in (inches); for weight, lb (pounds), oz (ounces), kg (kilograms), or gms (grams).
4. Enter the patient's height and weight in the units of measure shown on the display. Press **Return** after each entry. The patient's body surface area will be calculated and displayed based on the height and weight you entered.
5. If appropriate, enter the **LMP** (Last Menstrual Period) date. Press **Return** after each entry. The system automatically calculates the gestational age using the LMP date, **GA (LMP)**. A calculation of the estimated date of delivery by the last menstrual period, **EDD (LMP)**, is also calculated. **GA (LMP)** and **EDD (LMP)** are displayed.
   – If the **LMP** is unknown, you can enter a date in **Estab. Due Date** and then press **Return**. The system will calculate an LMP date and designate it with a "c" for calculated value.
6. Enter the date in **Estab. Due Date** and press **Return**.
7. For Twins, enter **Y** or **N** (Yes or No) and press **Return**.

8. If previous ultrasound exam data exists, select **Prev Exam Data**. The **Previous Exam Data** is displayed (Figure 9–60).

   a. Enter the information into the **Previous Exam Data** form. There are ten exams available, and you should enter the data in chronological order, beginning with Exam #1. (If you entered **Y** for **Twins** in the **Study Data**, there will be two sets of previous exam data forms, one for Twin A and one for Twin B.)

   b. When finished, select **Close** to exit the **Previous Exam Data** form.

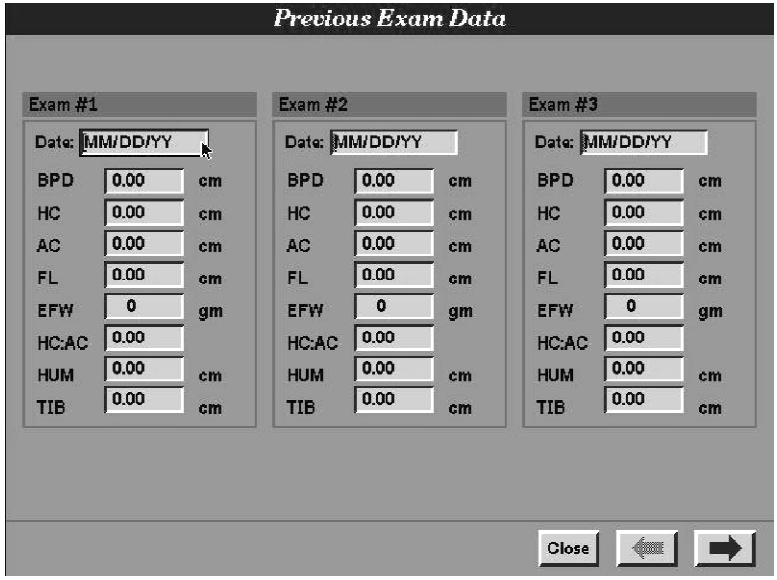
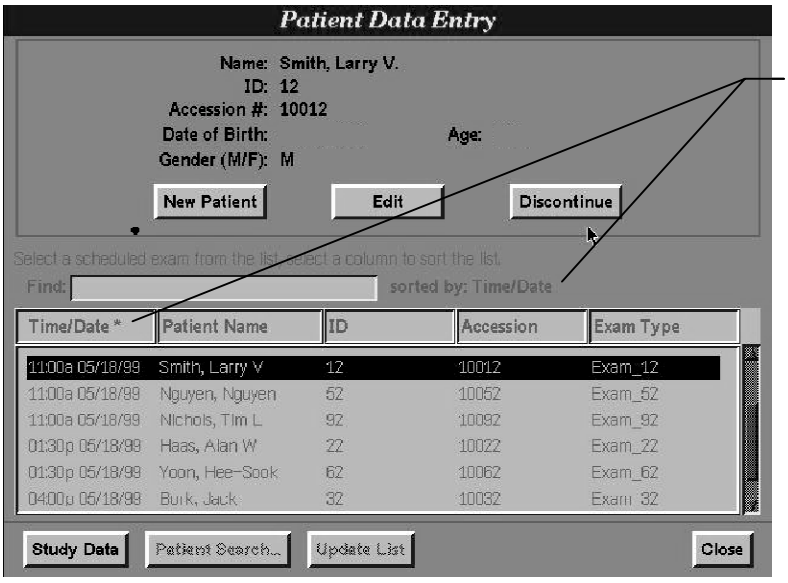


Figure 9–60. Previous Exam Data Screen

" **To find an entry on the worklist:**

1. Place the cursor over the column label you wish to use as the sort criteria and press **SELECT**. The Asterisk moves to the column header selected and the **sorted by** indicator changes to the header label tagged by the asterisk (Figure 9–61).



The **sorted by** label is changed by selecting the column heading you want, tagging it with an asterisk.

Figure 9–61. Selecting the Sorted By Column

2. Select the **Find** data entry field and type the entry in the same form as the **sorted by** indicator: time/date, patient name, ID and accession number, or exam type.
3. As you make your entry, the worklist scrolls the desired entry into view for selection (Figure 9–62). If the requested entry does not exist or there is a typing error, the text field goes blank when you press **Return**, and you can enter new data.

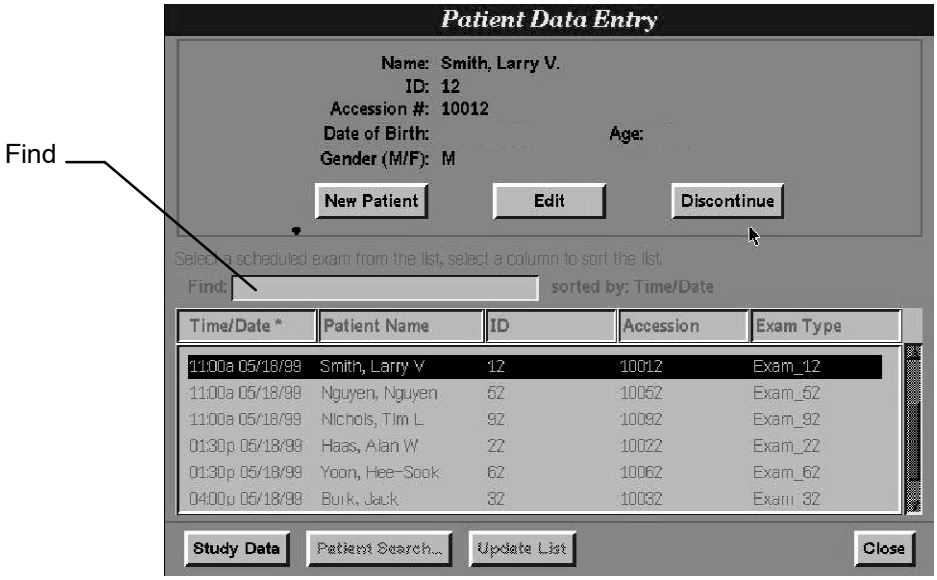


Figure 9–62. Find Function

Updating a Worklist

The Worklist feature has several ways you can set up the intervals and events for updating the worklist. **Patient Search** and **UpdateList** are two options for updating worklist using the **Patient Data Entry** form. Other options are covered in the section "Worklist System Setup," in this update.

" **To use Update List:**

1. Press the **Patient Data** key. The **Patient Data Entry** form appears.
2. Select **Update List**. A message, "Updating Modality Worklist," appears until one of the following occurs:
   - The message, "No items found," appears. Select **OK** to return to the **Patient Data Entry** form. If necessary, select **Update List** again to update the worklist. If the worklist is not updated, an appropriate error message will be displayed.
   - The message, "Items Found," appears with a numerical counter showing the number of patient entries transferred from the server to the system worklist. When the counting stops, the display returns to the **Patient Data Entry** form with a new worklist.

" **To use Patient Search:**

Success using **Patient Search** depends on the entries you make in the **Patient Search** data entry fields. Typing in a full name keeps the search narrowly defined to one patient. Typing in only the last name, such as “Smith,” will expand the search to include all patients with “Smith” as part of their full names. **ID**, **Procedure ID**, and **Accession #** are site dependent; check with those responsible for configuring the Worklist server at your site before using these data fields.

1. Select **Patient Search**. The **Patient Search** form is displayed.
2. Select the data entry field you want to use for the search. Type the data in a standard form used in the worklist. Your entries are case sensitive.
3. Select **Search**. A message appears, “Searching for Exams on the Worklist Server.” It is displayed until either the item is found or the search is complete. If no items are found, a message appears “No items found.” Try repeating your entry, or try restricting the terms of your search. All Worklist entries found on the server are transfered to the ultrasound system’s worklist, replacing the entries prior to your search.

   Example: You select **Patient Search** and type Patient_22 in the **Last Name** text field and press return. The worklist is cleared of the current list, and Patient_22 is the new list.

Optical Disk and Hard Disk

" **To install the optical disk:**

1. Read and observe all precautions listed on the optical disk package.
2. Remove the optical disk from its package.
3. Ensure that the data protect tab is set properly.
4. Orient the optical disk as shown in Figure 9–63. (Do not use an optical disk formatted in the optical disk drive shown in Figure 10–1.)
5. Push the optical disk into the optical disk drive until the drive pulls the disk the remainder of the way into the disk drive.

CAUTION

Do not move the system with a disk installed in the optical disk drive. Moving the system with a disk installed in the optical disk drive could result in a loss of data.

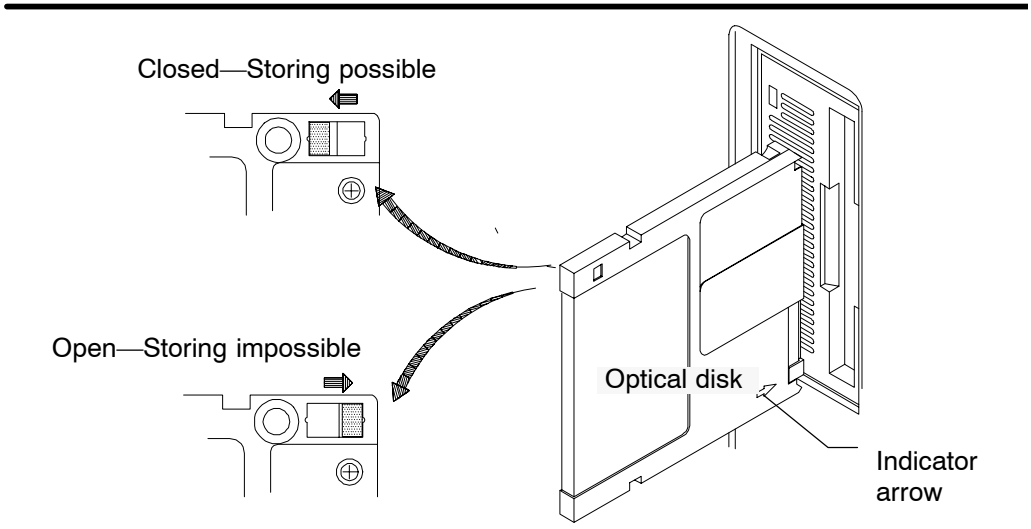


Figure 9–63. Optical Disk Installation

" **To format the optical disk:**

Before using the optical disk, ensure that it is formatted. Formatting the optical disk erases all information on the disk.

1. Press the **NET/DISK MENU** control. The **Net/Disk** menu appears.
2. Select **Format Disk**. A confirmation dialog box appears (Figure 9–64).

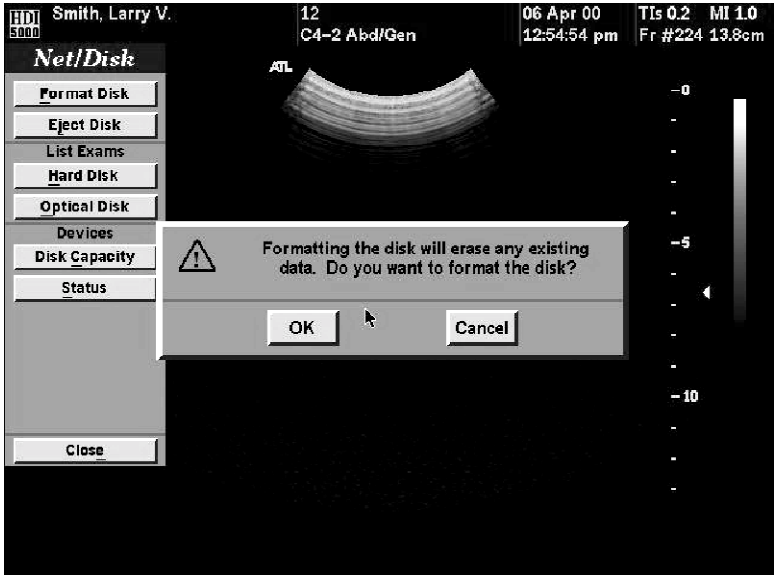


Figure 9–64. Formatting the Optical Disk

3. Select **OK** to start the disk format; **Cancel** if you do not want to format the disk. Formatting an unformatted disk takes about 10 minutes; formatting a previously formatted disk takes about 10 seconds. (The system can be used for imaging during formatting.)
4. Once formatting is complete, a completion dialog box appears (Figure 9–65).
5. Select **OK** to complete the disk format.

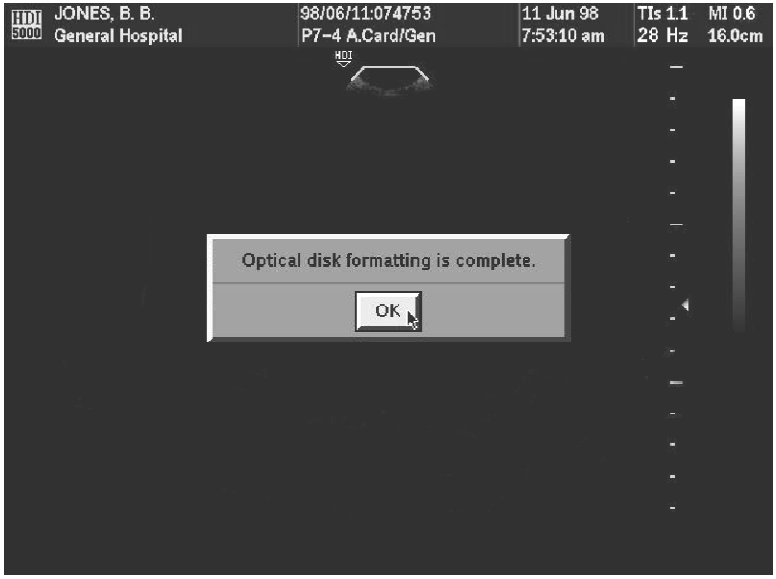


Figure 9–65. Completing the Optical Disk Formatting

" **To display disk capacity:**

1. Press the **NET/DISK** menu control. The **Net/Disk** menu appears.
2. Select **Disk Capacity**. The disk capacity dialog box appears (Figure 9–66). The values displayed are estimates; actual storage left depends on the types of images that will be stored. (If an optical disk is not installed, only hard-disk capacity will be shown.)

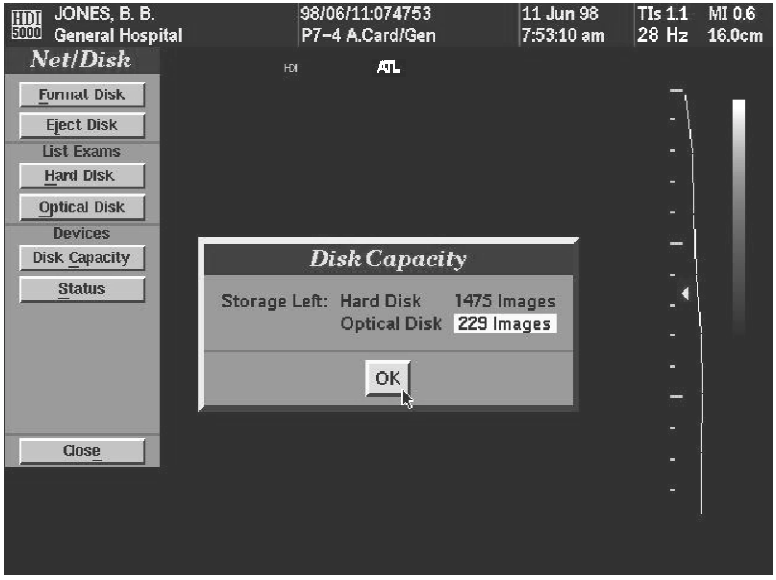


Figure 9–66. Disk Capacity

Storing and Printing Images

"Storing," "printing," and "saving" are terms people often use interchangeably to refer to the same thing. Storing images to the hard disk is performed with the **PRINT** control or the **Superkey** and the **Print Local** key. For this reason, storing to the disk and printing to the disk are often used to mean the same thing. Storing refers to the process, printing refers to the control that is used to initiate the process. Saving an image to disk is also a common term.

In this manual, we will use the term "storing" when referring to a disk operation. "Printing" will be used to refer to an actual print operation where a hardcopy of an image is produced. "Saving" will be avoided altogether.

When an image is stored to a device in the **Print All** environment, the Image Management icon on the screen changes color to indicate that the image has been assigned a location on a sheet of film (Figure 9–67). Each cell of the icon represents the location of an image on a sheet of film. The number of cells is determined by your printer setups.

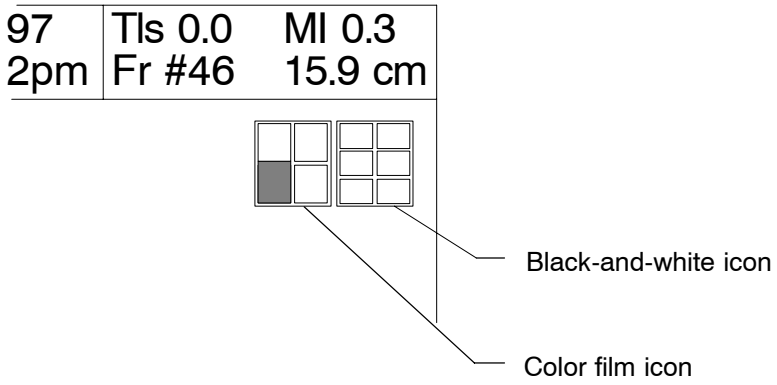


Figure 9–67. Image Management Icons

The purpose of the icon is solely to provide you an understanding of the film formatting in the **Print All** environment. The icon provides status about the sheet of film that is being used. You will notice that the icon briefly disappears when you store an image.

In the **Selective Print** environment this film formatting is unnecessary or undefined, therefore, status is unavailable. The icon will not appear on the screen when the **Print Environment** is **Selective Print**. The icon is not stored on the film with the image and it does not appear on the print.

When you store an image, the system beeps once to indicate that the image is stored.

The **Image Management** setups contain a system setup that allows you to determine when you want a storage capacity warning. The setup, **Display Warning When**, specifies when the system will display a message about the remaining space on the storage devices. This message can alert you to move images from the hard disk to an optical disk or delete images from the hard disk altogether. You can use the **DEL IMG** control to delete the last image or loop that you stored on the hard disk, and you can use the exam directory controls to delete exams from the hard disk.

Images are sent to the optical disk or their network destinations after you store them or at the end of the exam. The **Store Images During Exam** setup in the **Image Management** setups determines how and when this transfer occurs.

Storing Images

" **To store an image with the PRINT control:**

1. Ensure that you have entered patient data. (See "To enter patient data.")
2. Ensure that the **Use Print Button To** setup is set to **Store to Disk**.
3. Acquire the image that you want to store.

Note *You can store a frozen image or a live image.*

4. Press the **PRINT** control. The system beeps once to indicate that the image was stored.

" **To store an image with the Superkey and Print Local key:**

1. Ensure that you have entered patient data. (See "To enter patient data.")
2. Ensure that the **Use Print Button To** setup is set to **Print Local (Internal)**.
3. Acquire the image that you want to store.

Note *You can store a frozen image or a live image.*

4. Press the **Superkey** and **Print Local** key. The system beeps once to indicate that the image was stored.

Storing Loops

The size of the loop, measured in number of images, that you can store is determined by the **Stored Loop Size** setups in the **General Options** setups (B/W and Color). Two other factors may affect the size of the loop being stored: trimming and the number of images in the Cineloop memory buffer.

Once you have established the size of the loop, the process of storing a loop consists of pressing the **FREEZE** control, which displays the **CAPTURE** softkey. Pressing the **CAPTURE** softkey stores the loop. Loop capture is only available when the system is frozen, and only images already acquired can be stored as a loop on the hard disk.

" **To store a loop:**

1. Ensure that you have entered patient data. (See "To enter patient data.")
2. Press the **FREEZE** control. The **CAPTURE** softkey appears.
3. If necessary, press **3D/CINE** and use the **Cineloop** menu controls to trim the loop.
4. Press the **CAPTURE** softkey. The loop is stored, and the system returns to its previous state.

Deleting Images and Loops from the Hard Disk

You can delete images stored on the hard disk. The number of images you can delete depends upon the **Store Images During Exam** setup: if **After Each Image** is set, then you can delete the last stored image; if **End of Exam** is set, then you can delete all stored images. You cannot delete images that have been spooled to an optical disk or to a network device. Deleting images and exams from the directories are explained under those topics later in this section.

Loops are treated like images in that loops are considered a single entity, equivalent to an image.You can delete the last loop stored on the hard disk. You cannot delete loops that have been spooled to a network device.

Deleting images, loops, and exams from the directories are explained under those topics later in this section.

" **To delete an image or a loop from the hard disk:**

1. Press the **DEL IMG** control. A system dialog box appears (Figure 9–68).
2. Select **Delete**. The image or loop is deleted.

Figure 9–68. Deleting Stored Images or Loops

Printing Images

A local printer is a printer that is installed inside your system. You can print an image using the system **PRINT** control, as described in this procedure, or you can use the **Superkey** and **Print Local** key to print. Your specific system **Print Environment** and the **Image Management** setup, **Use Print Button To**, determine which method is active.

" **To print an image with the PRINT control:**

1. Ensure that you have entered patient data. (See “To enter patient data.”)
2. Ensure that the **Use Print Button To** setup is set to **Print Local**.
3. Obtain the image that you want to print.
4. Press the **PRINT** control. The image is printed by the local printer.

" **To print an image with the Superkey and Print Local key:**

1. Ensure that you have entered patient data. (See “To enter patient data.”)
2. Ensure that the **Use Print Button To** setup is set to **Store to Disk**.
3. Obtain the image that you want to print.
4. Press the **Superkey** and **Print Local** key. The image is printed by the local printer.

Using the Exam Directory

You can view the exam directories of the hard disk and the optical disk. The **NET/DISK** menu control provides access to the **Net/Disk** menu from which you can select the desired exam directory.

Once the exam directory is displayed, you can select exams from the hard disk for review, copy exams to another destination, print exams, and delete exams from the exam directory. Before you can review, print, delete, or copy exams, you must select the exams. The hard disk review, print, delete, and copy functions are unavailable until an exam has been selected.

" **To display an exam directory:**

1. Press the **NET/DISK MENU** control. The **Net/Disk** menu is displayed.
2. Select **Hard Disk** or **Optical Disk**. The exam directory that you selected is displayed.

" **To select and deselect exams:**

1. Display the exam directory. See “To display an exam directory.”
2. You can select and deselect the exams individually or select and deselect all of the exams in the exam directory.
3. To select and deselect the exams individually:
   a. Highlight the exam and press the **SELECT** control.
   b. Press the **SELECT** control to deselect the exam previously selected.
4. To select and deselect all of the exams in the exam directory:
   a. Select **Select All** at the bottom of the exam directory. All of the exams in the directory are highlighted.
   b. Select **Select All** again to deselect all of the exams previously selected.

" **To copy an exam:**

Choose an opportune time to copy patient exams from the optical disk to the hard disk, from the hard disk to the optical disk, or from the hard disk to network devices. Due to network activity and configuration, these activities can take several minutes to complete. If you wait to do these things just before you turn off the system, the power-down sequence takes longer than normal.

CAUTION

If the power-down sequence takes longer than you think it should, based on the system prompts, system activity, and your understanding of the activity; you can toggle the **ON/STANDBY** switch. There will be some risk to the file transfer at this point. If this situation occurs, notify ATL Customer Service.

1. Display the exam directory that contains the exams that you want to copy, see "To display an exam directory."
2. Select the exams that you want to copy from the exam directory, see "To select and deselect exams."
3. Select **Copy To** at the bottom of the exam directory. An appropriate dialog box appears for the source and destination.
4. Select the destination to which you want to copy the exams. You can also cancel the copy, if you want to. If you select **Network**, the selected exams will be copied to all of the current archive devices defined in the system setups.

" **To print an exam:**

In the hard disk exam directory, you can print tagged images using the following steps. You can also retag images, which is described later in this section ("To reprint an image"). Additionally, you can print the contents of the exam directory, if the **Use Print Button To** setup is set to **Print Local (Internal)**, see step 2 below.

1. Display the exam directory that contains the exams that you want to print, see "To display an exam directory."
2. Select the exams that you want to print from the exam directory, see "To select and deselect exams." (If you do not select an exam, but you press the **PRINT** control, then the exam directory is printed.)
3. Press the **PRINT** control. The **Print Exam** dialog box appears.
4. Select the destination to which you want to print the exams.
5. Select **OK**. You can also cancel the print, if you want to. The exam directory is displayed again.

" **To delete an exam:**

1. Select the exams that you want to delete from the exam directory, see "To select and deselect exams."
2. Select **Delete** at the bottom of the exam directory. A "Delete exam?" dialog box appears.
3. Select **Delete** on the dialog box. You can also cancel the deletion, if you want to. Pending exams are also deleted from the queue.

Reviewing Images and Loops

You can review images and loops on the hard disk using the system controls. You can select and deselect images and loops for tagging and replacement. You can also change the review format, delete an image, and page through the image review. You can measure edit and review images. These procedures are described below.

" **To review images on the hard disk:**

- To review images from the current exam, press the **REVIEW** control. The **Review Images** screen appears.
- In the exam directory, you can review images by selecting the exam and then **Review Images**. You can select exams for review one at a time.

" **To select an image from the Review Images screen:**

1. In **Review Images**, use the trackball to move the cursor to the desired image. A highlight surrounds the image.
2. Press the **SELECT** control. The highlight changes to indicate selection of the image.

" **To review a loop on the hard disk:**

1. In **Review Images**, use the trackball to move the cursor to the loop icon (Figure 9–69).
2. Press the **SELECT** control. The loop is retrieved and is displayed.
3. Use the selections on the **3D/CINE** menu to start or stop the loop, adjust the speed, and select sweep or loop playback mode.
4. Use the trackball to review individual images within the loop.
5. Press the **REVIEW** control to exit loop review and return to the **Review Images** screen.

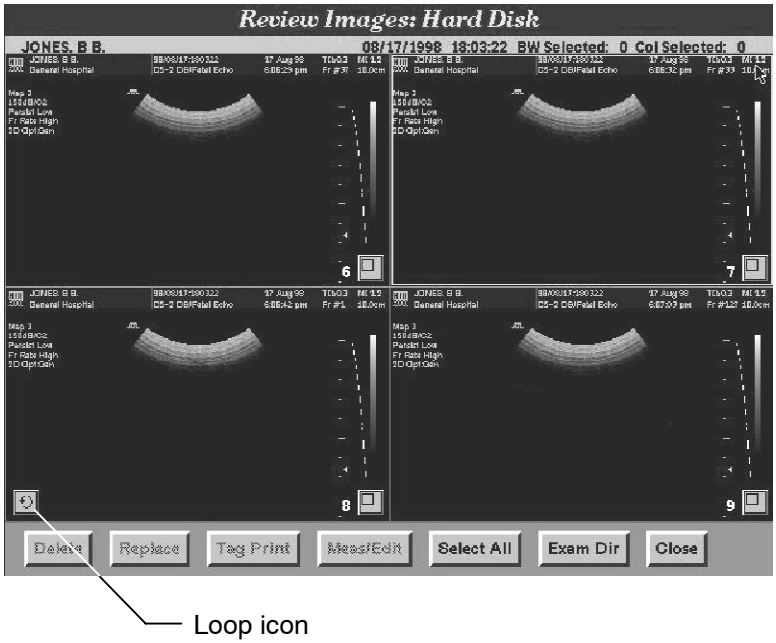


Figure 9–69. Loop Icon

" **To tag images for printing:**

Before you can select images to tag for printing, you must set up the **Print Environment** for **Selective Print** in the **Image Management** system setups. If you select **Print All** in the **Image Management** system setups for the **Print Environment**, then images will be automatically tagged for print when you store them. See also "To reprint an image (optical disk only)."

1. From the exam directory, select **Review Images**.
2. In **Review Images**, select the images that you want to tag for printing. One or more of the images can be tagged for print.
3. Select **Tag Print** at the bottom of the **Review Images** screen (Figure 9–70). The images are tagged. A tag graphic, an asterisk, appears in the bottom right corner of the image that you tagged.

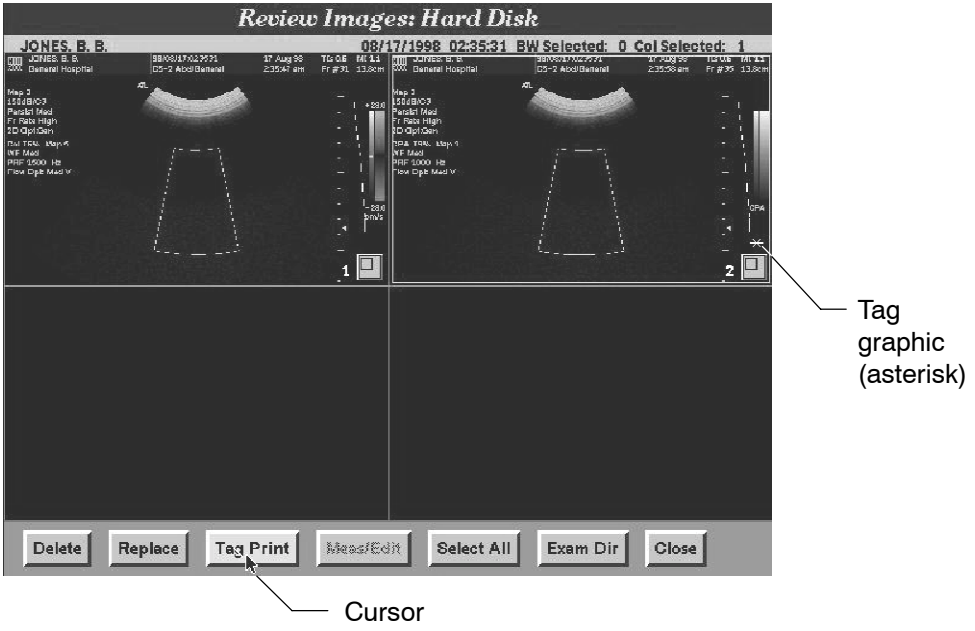


Figure 9–70. Tagging Images for Print

" **To print tagged images:**

- You can print tagged images on an optical disk by carrying the optical disk to an optical disk printer and using the printer to print the tagged images from the optical disk. Once images have been printed, to print them again, you must tag them again. If you wish to print them again, see “To reprint an image (optical disk only).”
- You can print tagged images that are stored to a network device by using the workstation print capability.

" **To reprint an image (optical disk only):**

When you tag images for printing, an electronic tag is used to identify the image for printing. When the image is printed, the printer resets this electronic tag. If you wish to print an image again, then the electronic tag must be reset.

1. Display the optical disk exam directory.
2. Select the exam or exams that you want to reprint. The images in the exam that were previously tagged for print will be selected for retagging.
3. Press the **PRINT** control. The tagged images in the exam are now retagged for printing.

" **To delete an image or loop (hard disk only):**

The **Store Images During Exam** setup determines if images can be deleted from the hard disk. Depending on the setup, images are spooled, either as they are stored or at the end of the exam, to the archive device, and once on the archive device they cannot be deleted individually: only pending images can be deleted from the hard disk.

1. From the **Review Images: Hard Disk** screen, select the images that you want to delete.
2. Select **Delete** at the bottom of the **Review Images** screen (Figure 9–71). A dialog box is displayed (Figure 9–72).

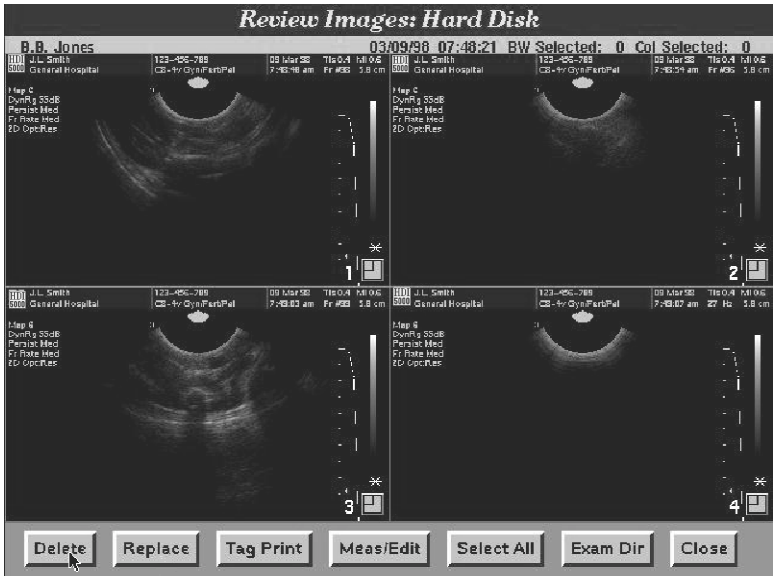


Figure 9–71. Deleting Images

3. Select **Delete** on the dialog box to confirm the deletion of the image. The images are deleted and the film icon and film page is automatically recalculated and reformatted.

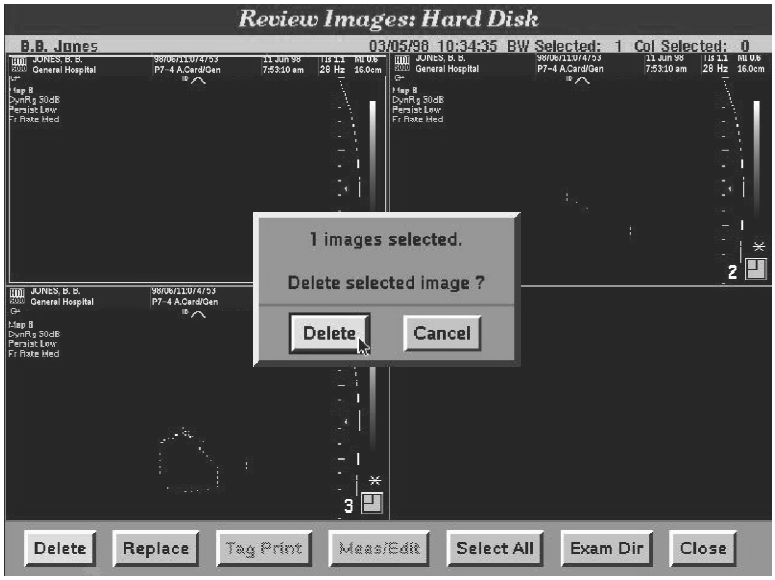


Figure 9–72. Deleting Images Dialog Box

" **To replace images or loops (hard disk only):**

If you have been storing images to the optical disk or the network during the exam, based on your **Image Management** setups, only the last image that you stored will be available on the hard disk for replacement.

1. From the **Review Images: Hard Disk** screen, select the images that you want to replace.
2. Select **Replace** at the bottom of the **Review Images** screen (Figure 9–73). A dialog box is displayed (Figure 9–74).

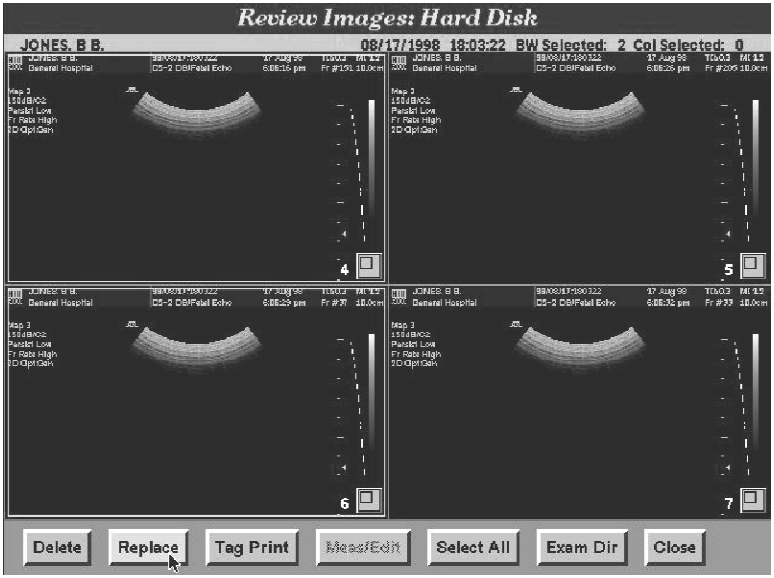


Figure 9–73. Replacing Images

3. Select **Replace** on the dialog box to confirm the action. The cells are emptied, and the number of images are recalculated and reflected in the film format graphic.
4. Select **Close**. The system resumes imaging.
5. Press the **PRINT** control to store the image that will replace the image selected in steps 1 through 4.

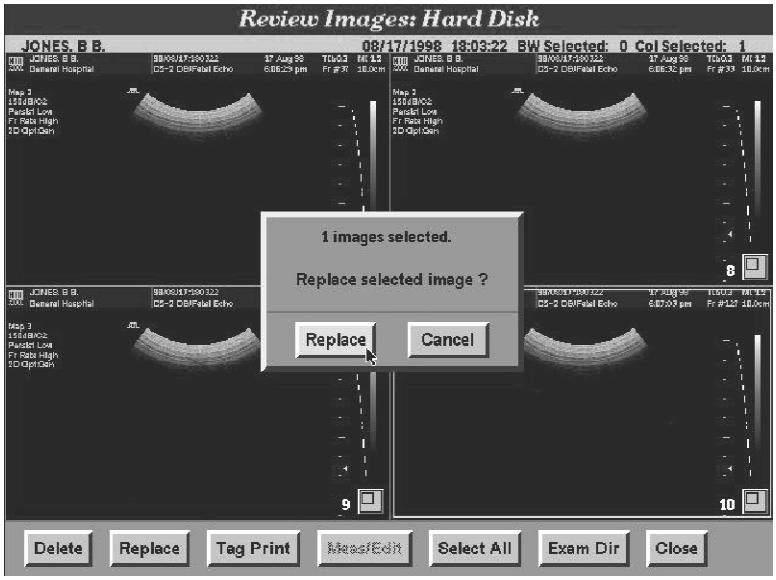


Figure 9–74. Replacing Images Dialog Box

" **To change the review format:**

You can set the review format in the **Image Management** system setups, or you can change the review format from the **Review Images** screen.

1. In **Review Images**, with the 4-on-1 review format, select the review format box in the right bottom corner of the image display (Figure 9–75). The image is now 1-on-1 (Figure 9–76).
2. To return to a previous review format:
   a. To the 4-on-1 review format, you select the review format box on the 1-on-1 image.
   b. To the 1-on-1 review format, you select the review format box on the 4-on-1 image.
   c. To real-time imaging from **Review Images**, press the **REVIEW** control.

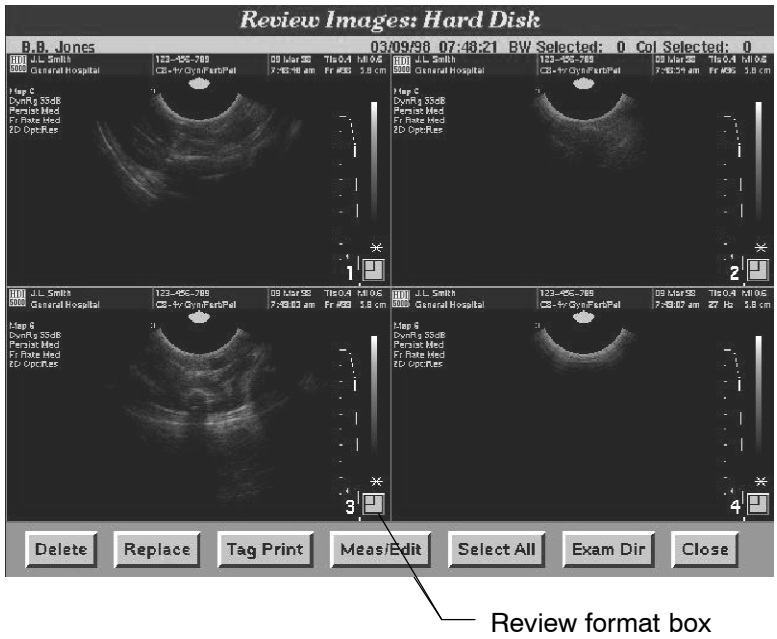


Figure 9–75. 4-on-1 Review Format

Figure 9–76. 1-on-1 Review Format

" **To edit a review image or loop:**

You can edit and add annotation on a review image or loop. After editing the annotation, you must press the **PRINT** control to append the image to the patient file.

1. In **Review Images**, make sure that the image is in the 1-on–1 image review format (Figure 9–76). See "To change the review format," if necessary.
2. Select **Meas/Edit** at the bottom of the screen. The **Review Images** display changes (Figure 9–77).

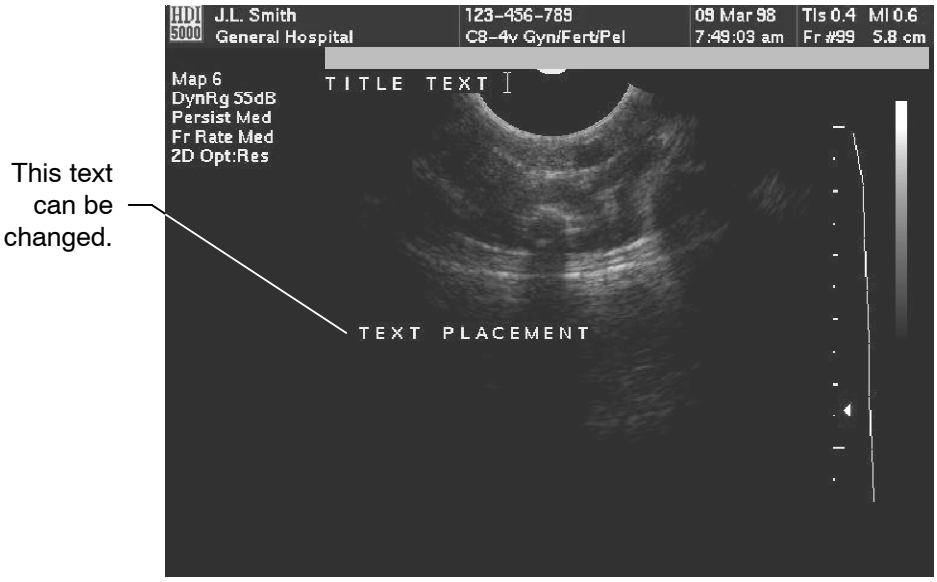


Figure 9–77. Meas/Edit Review Image Display

3. Use the **Text**, **Title**, and other keyboard keys to edit the annotation as needed (**Text A–B**, **Bodymarker**, **arrow** keys, and **SH Pos** do not work in review).
4. Press the **PRINT** control to append the edited image to the patient file.
5. Press the **REVIEW** control to see the edited image.

" **To measure a review image:**

Before a review image can be measured, it must be calibrated, or an existing calibration must be accepted. After measuring the image, you must press the **PRINT** control to append the image to the patient file.

1. In **Review Images**, make sure that the image is in the 1-on–1 image review format (Figure 9–76). See "To change the review format," if necessary.
2. Select **Meas/Edit** at the bottom of the display. The review image display changes (Figure 9–78).

Figure 9–78. Meas/Edit Review Image Display

3. Calibrate the image display as described in *Getting Started*.
4. Use the measurement tools to measure the image.
5. Press the **PRINT** control to append the image to the patient file.

" **To page through the images or the exam directory:**

From the **Review Images** screen or the exam directory, press the **Page** keys on the keyboard to move through the images or the exam directory (Figure 9–79).

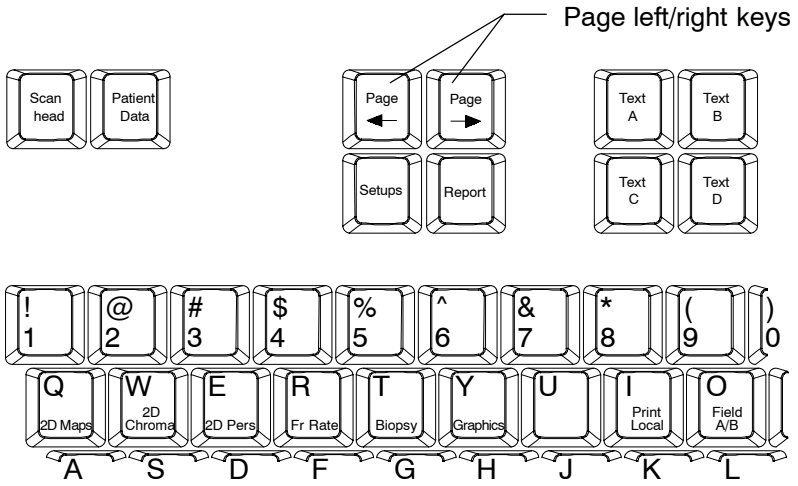


Figure 9–79. Page Keys

Ending an Exam

Ending an exam closes the current patient file. Press **END EXAM** as soon as an exam is complete.

If an optical disk is installed, pressing **END EXAM** sends the patient file or any remaining images not yet stored on the optical disk to the optical disk, and closes the patient file.

If the system is connected to a network, pressing **END EXAM** sends the patient file or any remaining images not yet stored to an archive device or devices you have specified and closes the patient file. If this activity is initiated close to the time that you turn off power, the power-down sequence will last longer than it normally does. During this time, the system completes the transfer of all patient files.

You can also use **END EXAM** to send images to the network devices when the **Send Images at End of Exam** setup is turned on.

CAUTIONS

- If the power-down sequence takes longer than you think it should, based on the system prompts, system activity, and your understanding of the activity; you can toggle the standby switch. There will be some risk to the file transfer at this point. If this situation occurs, notify ATL Customer Service.
- If you intend to move the system, ensure that you turn off power before disconnecting the network cable from the system.

" **To end the exam:**

Press the **END EXAM** control. A message appears to inform you that the exam is ended.

" **To eject the optical disk:**

1. Press the **NET/DISK MENU** control.
2. On the **Net/Disk** menu, select **Eject Disk** (Figure 9–80). The optical disk ejects from the optical disk drive.

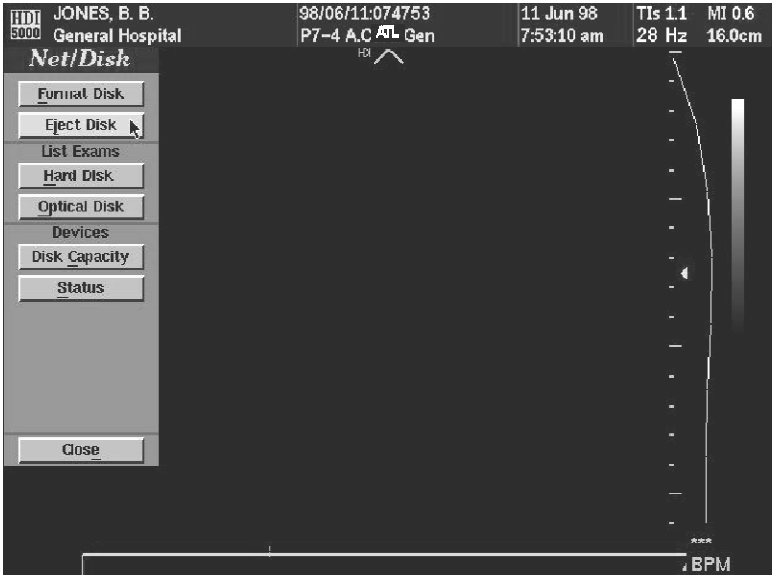


Figure 9–80. Net/Disk Menu: Eject Disk

Restarting an Exam

Restarting an exam occurs when you decide to add images to the current patient file, after you have ended the exam. You can only restart the current exam and open its patient file. When you restart an exam, you can change the patient data by selecting the edit feature in patient data entry. You cannot restart exams on the optical disk or those that have been copied or sent to the network.

" **To restart an exam:**

CAUTION To ensure that images from different patients are not inadvertently mixed together, be careful when entering or modifying patient data.

1. Press the **Patient Data** key. The patient data entry form is displayed.
2. Select **Edit**. If you modify the patient name, the images stored will be appended to the current patient file.

3. Select **Close**. The patient data entry form is removed from the display and the patient data saved.
4. Perform Image Management operations as necessary. Refer to the appropriate procedures in these operating instructions as necessary.

" **To add an image to an exam after ending the exam:**

After pressing **END EXAM**, you can add images to the current patient exam as follows.

1. Press the **PRINT** control to store an image on the hard disk, or press the **CAPTURE** softkey to store a loop.
2. Press **END EXAM** to store an image or images to the optical disk or network devices and end the exam.

Using WebLink Connectivity

" **To use WebLink connectivity:**

If you are a system administrator, and you require access to system administration functions, refer to the description of system administration functions related to WebLink connectivity earlier in this section.

The layout of the password dialog box and other display aspects depend on your personal computer software. Please, keep this in mind when reading the following instructions.

1. Ensure that your system is set up for the WebLink option. Refer to "To set up your system for WebLink operation."
2. On your computer, start your Web browser. (Web browsers vary. Some common examples are Navigator or Explorer.)
3. In the Web browser, enter the site address (URL) for the ultrasound system. (For example: http://HDI5000_170, where "HDI5000_170" is the network alias of the ultrasound system.) You can also enter the IP address of the ultrasound system. The password dialog box appears (Figure 9–81).

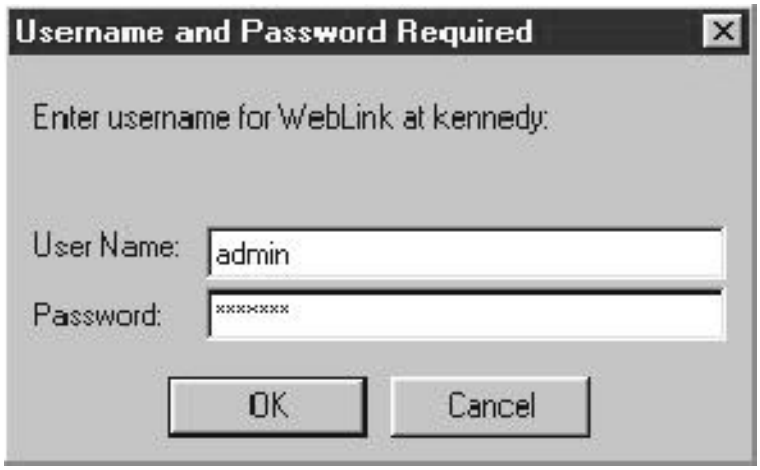


Figure 9–81. Password Dialog Box

4. Enter your **User Name**, and then move the cursor to the **Password** field. (When you first start the WebLink feature the **User Name** is “admin.” Entering “admin” as a User ID will give you access to the **Administrative Menu**. In the **Administrative Menu**, passwords and user IDs can be changed, as needed.)
5. Enter your password. (When you first start the WebLink feature, the password is “weblink.” You will want to change this for security reasons.)

6. Select **OK**. If the authorization is valid, then the WebLink **Administrative Menu** appears (Figure 9–82). **Cancel** cancels the submittal.

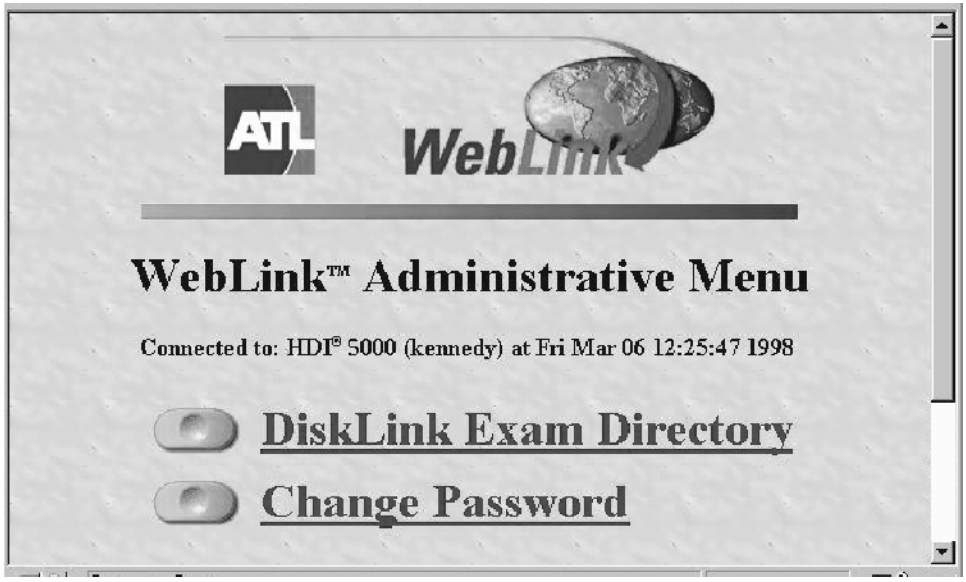


Figure 9–82. WebLink Administrative Menu

7. On the **WebLink Administrative ~~main~~ Menu**, select **DiskLink Exam Directory**. The **DiskLink Exam Directory** appears (Figure 9–83).
8. Move the cursor to one of the exams in the exam directory.

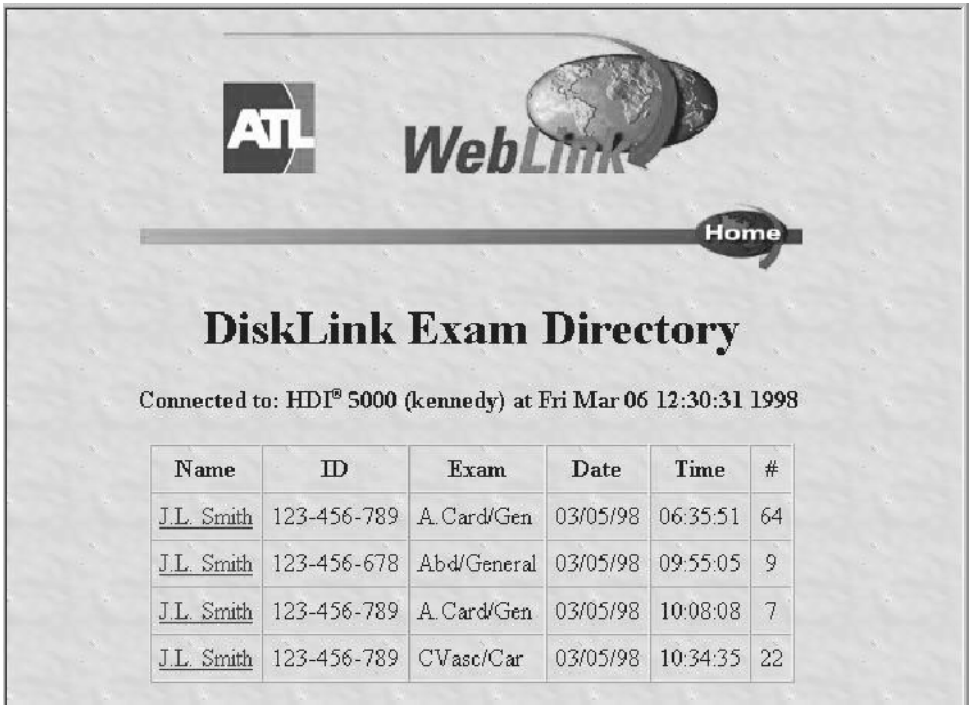

ATL
WebLink
Home
DiskLink Exam Directory
Connected to: HDI® 5000 (kennedy) at Fri Mar 06 12:30:31 1998
Name ID Exam Date Time #
J.L. Smith 123-456-789 A.Card/Gen 03/05/98 06:35:51 64
J.L. Smith 123-456-678 Abd/General 03/05/98 09:55:05 9
J.L. Smith 123-456-789 A.Card/Gen 03/05/98 10:08:08 7
J.L. Smith 123-456-789 CVasc/Car 03/05/98 10:34:35 22

Figure 9–83. DiskLink Exam Directory

9. When the selection hand icon appears, press the **select** control on your mouse. The **DiskLink Image Directory** appears (Figure 9–84).

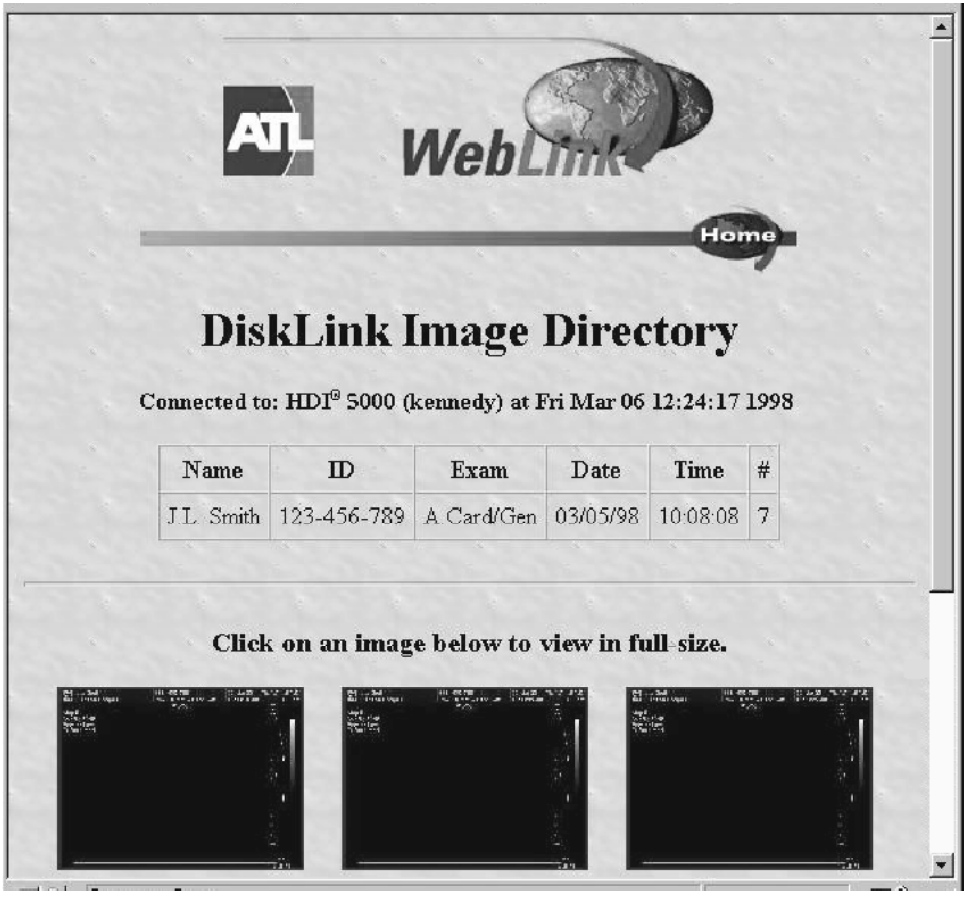


Figure 9–84. DiskLink Image Directory

10. Move the cursor to one of the images in the image directory.

11. When the selection icon appears, press the **select** control on your mouse. The full-size image appears (Figure 9–85).

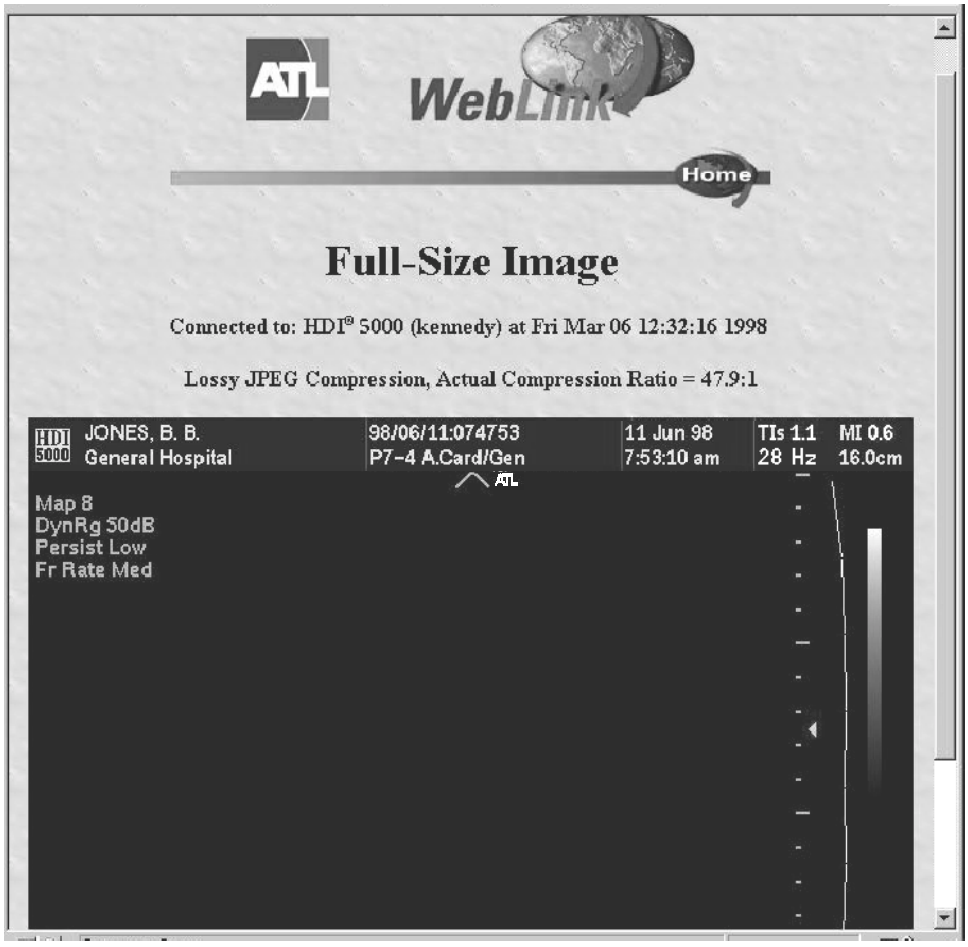


Figure 9–85. WebLink Full-Size Image Display

Digital Video Streaming Option

The Digital Video Streaming (DVS) option allows real-time digital-data acquisition and review. The DVS module is located in the system OEM bay (Figure 10–1). An optional stress echocardiography feature is available with the DVS option.

The DVS option provides digital echocardiography capabilities and an optional stress echocardiography feature useful in the diagnosis and management of the patient with coronary artery disease. “Digital echocardiography” is a general term used to describe the combination of ultrasound and digital archiving technologies that allows the acquisition, formatting, analysis, storage, and review of the echocardiography exam.

The DVS module consists of a hard disk, magneto optical disk drive, and a floppy disk drive (the floppy disk drive is not currently functional). A DVS hand controller can be connected to the back of the system control panel.

Figure 10–1. DVS Module

Operating Instructions

Starting an Exam

Starting an exam begins with entering patient data. You can enter new patient data, edit patient data, or select a patient from the patient list. When you enter patient data, an electronic file is created for the patient. Any images that you store for that patient are identified by the patient data and included in that patient's file. If you do not enter an ID for a patient, the system will automatically assign an ID for the patient.

Patient Data

When you press the **Patient Data** key, the **Patient Data Entry** form appears (Figure 10–2).

- **New Patient** displays the **New Patient** form (Figure 10–3).
- **Edit** displays the **Edit Patient** form, which allows editing of the patient data on the current exam (Figure 10–4).
- **Patient List** displays the **Patient List** (Figure 10-7), which includes the following:
  - Drive-selection drop-down list.
  - A directory or alphabetical list of patients and studies, which can be expanded (+) or collapsed (–).
  - **New Study** is used to load information for the selected patient.
  - **Append Study** is available when a single study is selected. Selecting **Append Study** loads all study data and patient information for the selected patient into the **Patient Data Entry** form and study data fields.
  - **Cancel** exits the **Patient List** without selecting a patient or a study.

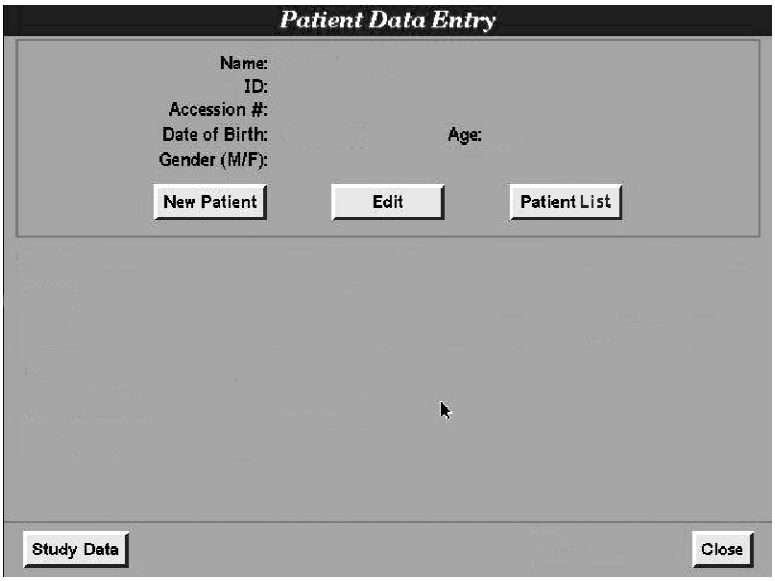


Figure 10–2. Patient Data Entry Form

" **To enter new patient data:**

Note *Verify that the date and time are accurately displayed.*

1. Press the **Patient Data** key. The **Patient Data Entry** form appears (Figure 10–2).
2. Select **New Patient**. The **New Patient** form is displayed (Figure 10–3).

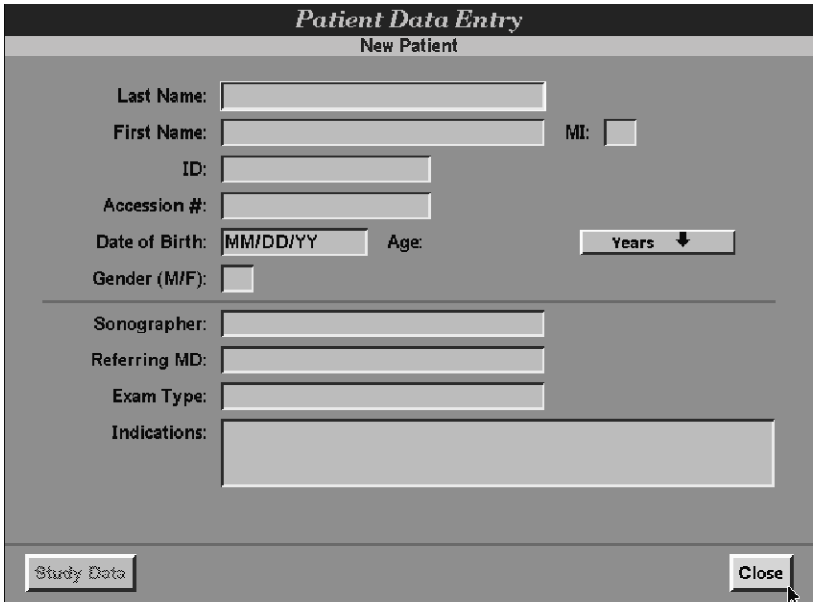


Figure 10–3. New Patient Form

Note *The text default is uppercase. Press the **Shift** key for lowercase text.*

3. Use the keyboard to enter data into the data entry fields. Press **Return** to advance to the next data field or select each field for data entry.
4. Press the **Patient Data** key, or select **Close**, to save the patient data and begin imaging.

" **To edit patient data:**

1. Press the **Patient Data** key. The **Patient Data Entry** form appears (Figure 10–2).
2. Select **Edit**. The **Edit Patient** form appears (Figure 10–4).

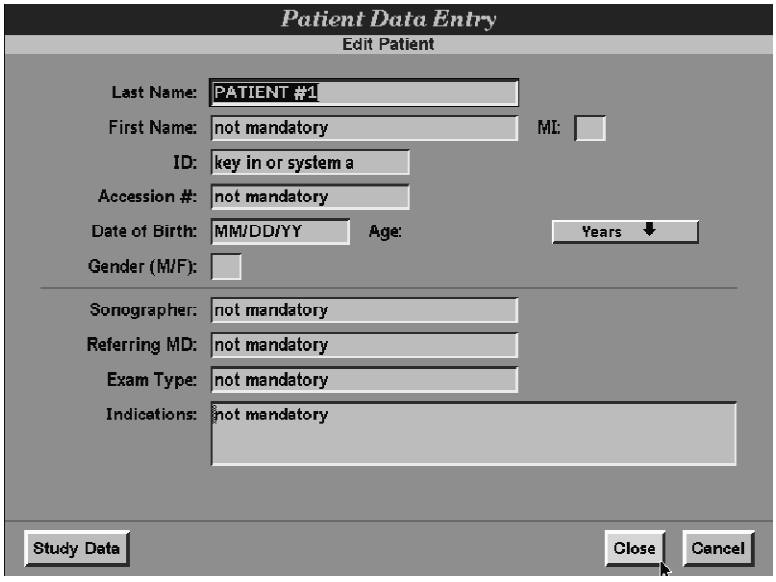


Figure 10–4. Edit Patient Form

3. Use the keyboard to edit patient data. Press the **Return** key after each entry.
4. Press the **Patient Data** key, or select **Close**, to save the patient data and resume imaging. (Select **Cancel** to exit the **Edit Patient** form without saving changes.)

" **To enter study data:**

1. Select **Study Data**. The study data fields appear (Figure 10–5).

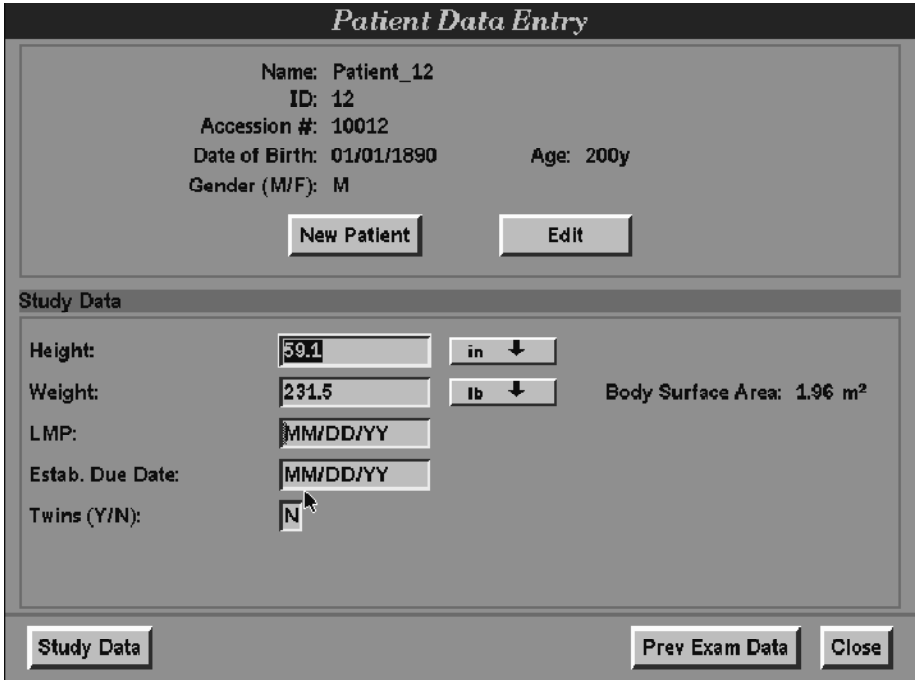


Figure 10–5. Study Data Form

2. If necessary, change the units of measure in the **Study Data**:
   a. Select the units of measure. A drop-down list appears
   b. Select the units of measure in the drop-down list. Units of measure include the following: for height, **cm** (centimeters) or **in** (inches); for weight, **lb** (pounds), **oz** (ounces), **kg** (kilograms), or **gms** (grams).
3. Enter the appropriate information, and select **Close** to exit the **Previous Exam Data** form.

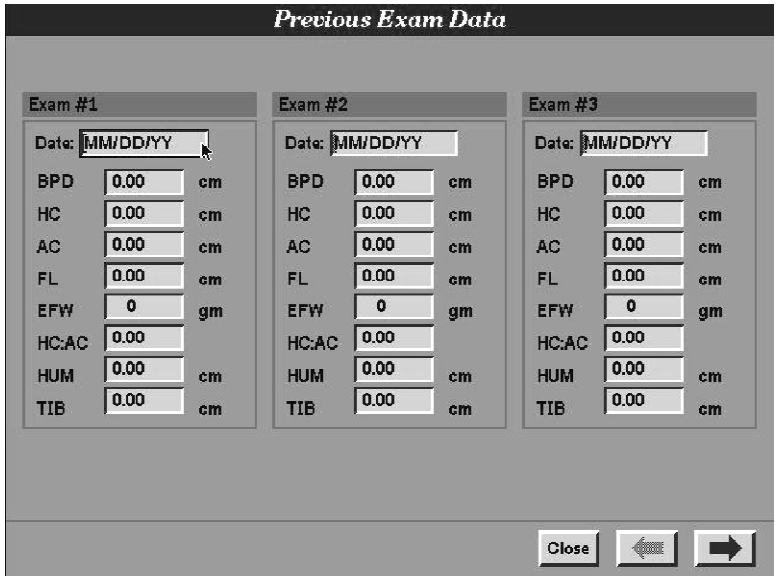


Figure 10–6. Previous Exam Data Form

" **To use the patient list:**

The patient list contains a hierarchy based on patient name and study date. The patient names are listed alphabetically, and the studies for each patient are listed chronologically. Selecting a patient name in the left side of the patient list, displays the studies for that patient in the right side of the patient list. Selecting the study in the left side of the patient list displays the series information for the selected study in the right side of the patient list. You can also expand and collapse the patient list by selecting the expand icon (+) or collapse the patient list by selecting the collapse icon (–).

For information about patient file management, see "To use the patient directory" later in this section.

1. Press the **Patient Data** key. The **Patient Data Entry** form appears.
2. Select **Patient List**. The **Patient List** appears (Figure 10–7).

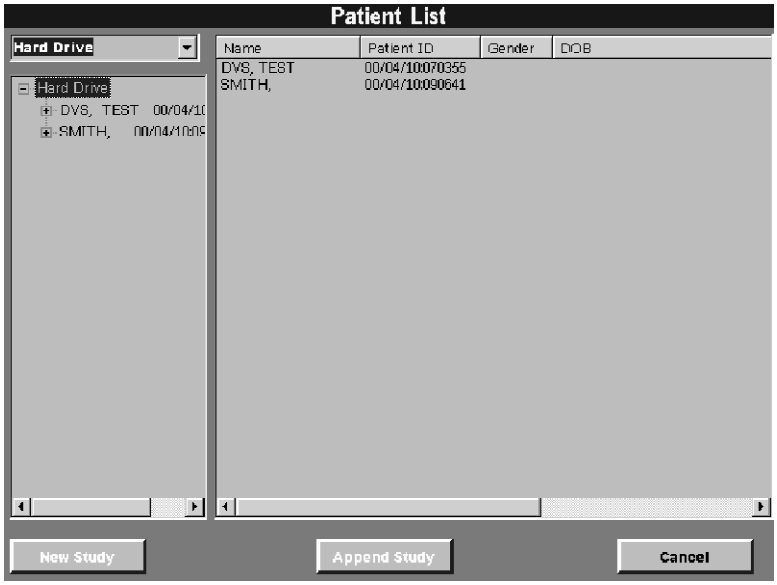


Figure 10–7. Patient List

3. Select the drive selection drop-down list to display the **Hard Disk** and **Optical** selections. A patient list for the hard disk or the optical disk appears.
4. Select the expand icon (+) for a patient in the patient list. The studies for the selected patient appear beneath the patient name in the left side of the patient list.
5. Select the study date. The series associated with the selected study appears in the right side of the patient list. The title, number (#) of images in the series, and the date and time of the series are presented.
6. To append a series to the study, select **Append Study**. The **Patient Data Entry** form appears with the selected patient's data.
7. If necessary, select **Edit** to display the **Edit Patient** form (see "To edit patient data").
8. Select **Close** to close the **Patient Data Entry** form and begin imaging.

Freeform Acquisition

Freeform acquisition or capture refers to the acquisition of images (clips or frames) without the use of an acquisition protocol. The rules that apply to freeform acquisition are as follows:

- ECG triggering is not applicable to single-frame images.
- Single-frame images are captured in full-screen format.

- The **Accept Prior to Store** setup is disabled in freeform acquisition.
- You determine the compression level using the **Compression** setup.
- Acquisition of live or frozen images is possible.
- Each freeform acquisition is labeled, **FREEFORMn**, where n is the number designating the order of the acquisition.

" **To set up for a freeform acquisition:**

1. Press the **Setups** control. The **Directory of Setup Options** appears.
2. Select **Acquisition Parameters.** The **Directory of Acquisition Parameters Setup Options** appears (Figure 10–8).

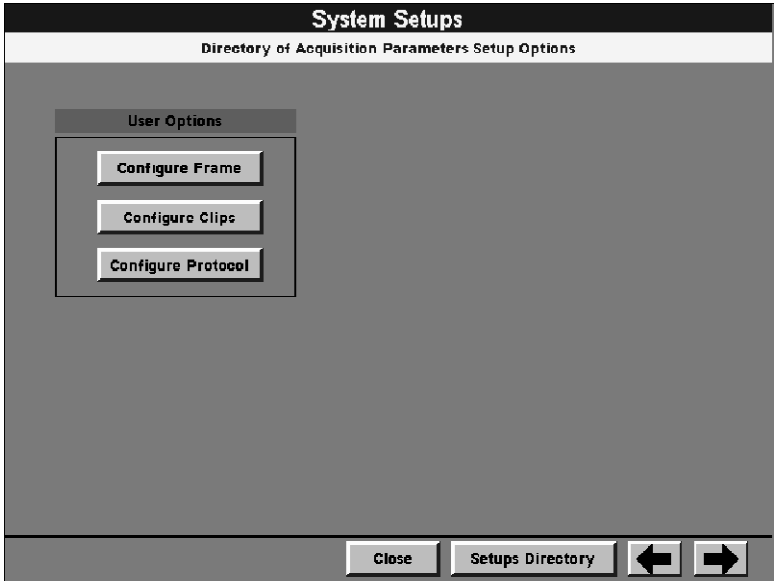


Figure 10–8. Directory of Acquisition Parameters Setup Options

3. Select **Configure Frame**. The **Acquisition Parameters – Frame** display appears (Figure 10–9).

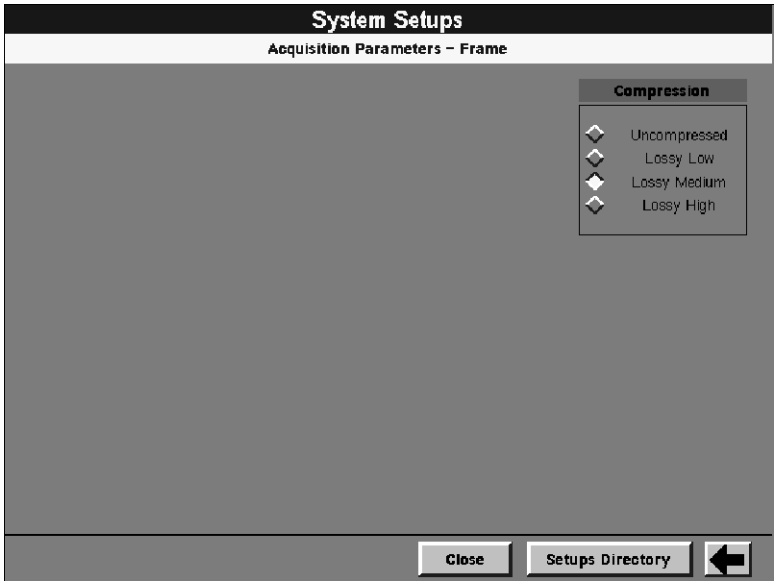


Figure 10–9. Acquisition Parameters – Frame

4. Select the **Compression** setting for frame acquisition.
5. Select the left arrow at the bottom of the display. The **Directory of Acquisition Parameters Setup Options** appears.
6. Select **Configure Clips**. The **Acquisition Parameters – Clips** display appears (Figure 10–10).

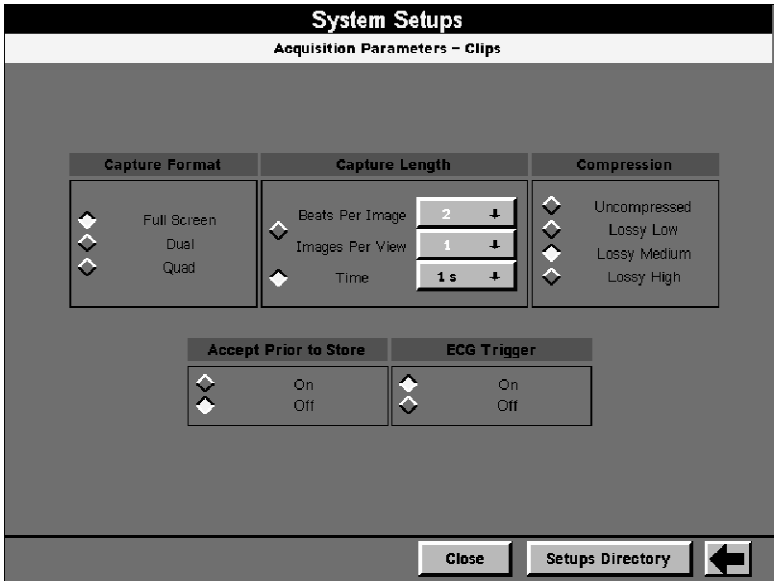


Figure 10–10. Acquisition Parameters – Clips

7. Select the desired **Capture Format**, **Capture Length**, **Compression**, **Accept Prior to Store**, and the **ECG Trigger** for clip acquisition.
8. Select **Close**. Imaging begins.
9. Press the **PARAMS** control. The **Exam Parameters** dialog box appears (Figure 10–11). The settings for clip acquisition are available from this dialog box during freeform acquisition.
10. Select **OK** to remove the **Exam Parameters** dialog box.

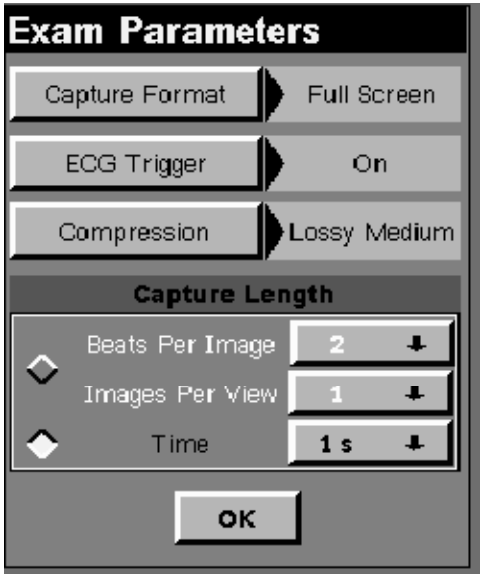


Figure 10–11. Exam Parameters Dialog Box

" **To perform a freeform frame acquisition:**

1. Begin imaging.
2. Press the **PRINT** control. The frame is stored to the hard disk.
3. See "To review images" later in this section.

" **To perform a freeform clip acquisition:**

1. Begin imaging.
2. Press the **CAPTURE** softkey. Depending upon your exam parameters, the system acquires the clip and the softkeys change state. Use the softkeys as needed:
   - The **PAUSE** softkey interrupts clip capture.
   - The **RESUME** softkey resumes clip capture.
   - The **DONE** softkey stops clip capture.
   - The **CANCEL** softkey stops clip capture, and deletes any captured images.
   - If **Accept Prior to Store** is enabled, the **ACCEPT** and **REJECT** softkeys appear, and you must accept or reject the acquisition, before the clip is stored.
   - If **Accept Prior to Store** is disabled, the clip is stored, based on your exam parameters.
3. See "To review images" later in this section.

Acquisition Protocols

The system includes five acquisition protocols: **Two Stage Full Disclosure**, **Two Stage Continuous**, **Pharmacologic**, **Three Stage Bicycle**, and **Digital Echo**. You can also create your own acquisition protocols, using the **Acquisition Parameters** setups.

Two Stage Full Disclosure

The **Two Stage Full Disclosure** acquisition protocol is a stress echo protocol consisting of two stages, rest and post. In the rest stage the following views are collected: PLAX, PSAX, A4C, and A2C. In the post stage, the same views are collected. The difference between the collection of views in the two stages is related to capture length**.** In the rest stage, the views are collected one beat per image and four images per view in the order specified by the acquisition protocol. In the post stage, views are captured in a full-disclosure format, up to 256 beats. Best beat selection occurs after each view is obtained in the rest stage. Best beat selection occurs after you acquire all of the images for the four views in the post stage.

The softkeys are programmed to appear as they are needed to support the acquisition protocol.

" **To use the Two Stage Full Disclosure acquisition protocol:**

Rest Stage

1. Enter patient data. (If necessary, refer to “Starting an Exam” in this section.)
2. Ensure the ECG leads are properly connected and that the ECG trace is turned on and adjusted properly. See the “Physio” section.
3. Prepare the treadmill.
4. Press the **PROTOCOL** control. The **Protocol Start** dialog box appears (Figure 10–12).

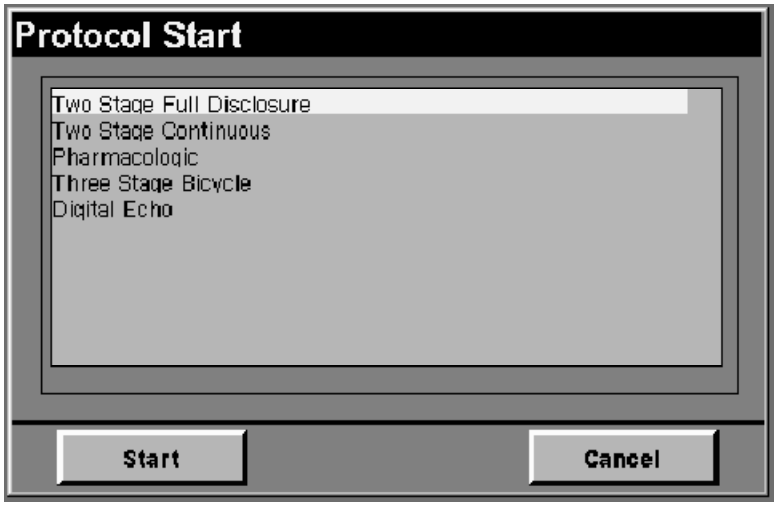


Figure 10–12. Protocol Start Dialog Box

5. Select **Two Stage Full Disclosure.**
6. Select **Start**.
   - **Start** initiates the acquisition protocol: a momentary message prescribing the required view appears above the image. Protocol status is located in the lower right corner of the display, containing the current compression level, timer setting, stage, and view (Figure 10–13).
   - **Cancel** aborts the acquisition protocol.
   - Pressing the **PROTOCOL** control during an acquisition protocol displays the **Protocol Suspend** dialog box. You can suspend the protocol, end the protocol, or cancel the dialog box.
7. Use the trackball to position the region of interest (ROI). The region of interest defines the region of the image that you are interested in capturing. (Press the **SELECT** control, if necessary, to display the trackball menu and enable ROI.)

Figure 10–13. Protocol Status

8. Press the **CAPTURE** softkey to capture the image from the prescribed view. The system is set up by default to **Accept Prior to Store**.
9. Press the **ACCEPT** softkey to accept the image collection, or press **REJECT** to return to imaging and acquire different images for this view. Once images have been accepted for the current view, the system enters best beat selection.
10. Use the trackball to position the cursor on the “Best Beat” image.
11. Press the **SELECT** control. The image is selected, as indicated by the outline around it. (You can select more than one image for “Best Beat” selection.)
12. Press the **STORE** softkey. The best beat selection is stored, the other images are discarded, and the system advances to the next view. You can use the **VIEW>** or **VIEW<** softkeys to return to a previous view or advance to the next view.
13. Press the **END** softkey after all images from the required views have been captured, accepted, and stored. The system initializes for the post stage**.**

Post Stage

14. Immediately after the patient gets off of the treadmill, press the **TIMERS** control. The timer (**T1**) begins to count the time for the post stage.
15. Acquire the first post-stage image.
16. Press the **CAPTURE** softkey. The image is captured, and a heart beat counter appears on the left side of the display (Figure 10–14). The counter displays the current number of beats recorded in full disclosure and the total number of beats that can be stored (for example: 2 of 256).

Figure 10–14. Heart Beat Counter

17. Continue to acquire the post stage images.
    - Press the **PAUSE** softkey to interrupt the post stage. (Use **PAUSE** if you want to change system control settings that affect image scaling.)
18. Press the **DONE** softkey after all images from the required views have been captured. The system automatically enters “Best Beat” selection (Figure 10–15). (If 256 cardiac cycles are acquired before you press the **DONE** softkey, the system automatically enters “Best Beat” selection for the post stage.)

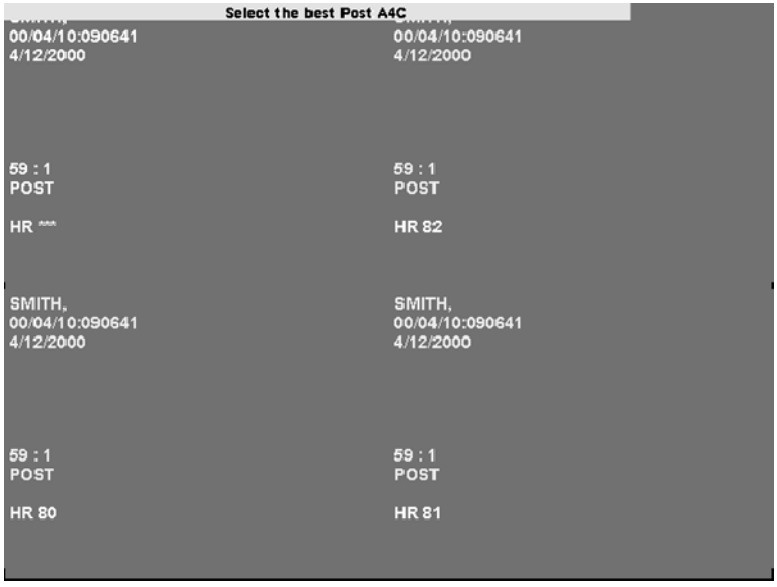


Figure 10–15. Best Beat Selection: Format

19. Use the trackball to position the cursor on the image that you want to store for the post-stage view. (The prompt at the top of the display indicates the view that will be assigned to the image you select.)
20. Press the **SELECT** control. The image is selected, as indicated by the outline around it. (You can select more than one image for “Best Beat” selection.)
21. Press the **STORE** softkey. The image is labeled, and the collection of images for the next view is displayed.
22. Repeat steps 19 through 21 until you have stored the required images and the “Best Beat” image from each view for the post stage is displayed in one collection.
23. If you decide to return to a view for which you have already selected an image, and you want to add or replace an image for that view, the **Add/Replace Image Labels** dialog box appears when you select the additional or replacement image (Figure 10–16).
    - **Add** labels the selected image with the current view name and adds it to the best beat selection.
    - **Replace** labels the selected image and erases the images previously labeled with the current view name.
    - **Cancel** removes the **Add/Replace Image Labels** dialog box.
24. Press the **END** softkey when you are finished reviewing the post-stage images. A comparison of rest and post stage images is displayed.

Figure 10–16. Add/Replace Image Labels Dialog Box

25. Press the **REVIEW** control to return to imaging.

Two Stage Continuous

The **Two Stage Continuous** acquisition protocol consists of two stages, rest and post. In the rest stage, the following views are collected: PLAX, PSAX, A4C, and A2C. In the post stage, the following views are collected: A4C, A2C, PLAX, and PSAX. Best beat selection occurs at the end of each stage.

The softkeys are programmed to appear as they are needed to support the acquisition protocol. An example of the **Two Stage Continuous** acquisition protocol follows.

" **To use the Two Stage Continuous acquisition protocol:**

Rest Stage of Two Stage Continuous protocol

1. Enter patient data. (If necessary, refer to "Starting an Exam" in this section.)
2. Ensure the ECG leads are properly connected and that the ECG trace is turned on and adjusted properly. See the "Physio" section.
3. Press the **PROTOCOL** control. The **Protocol Start** dialog box appears.
4. Select **Two Stage Continuous**.
5. Select **Start**.
   - **Start** initiates the acquisition protocol: a momentary message prescribing the required view appears above the image. Protocol status is located in the lower right corner of the display, containing the current compression level, timer setting, stage, and view.
   - **Cancel** aborts the acquisition protocol.
   - Pressing the **PROTOCOL** control during an acquisition protocol displays the **Protocol Suspend** dialog box. You can suspend the protocol, end the protocol, or cancel the dialog box.
6. Use the trackball to position the region of interest (ROI). The ROI defines the region of the image that you are interested in capturing. Press the **SELECT** control, if necessary, to display the trackball menu and enable the ROI.
7. Press the **CAPTURE** softkey to capture the image from the prescribed view. The image collection for the view appears. The system is set up by default to **Accept Prior to Store**.
8. Press the **ACCEPT** softkey to accept the image collection, or press **REJECT** to return to imaging and acquire different images for this view.
9. Repeat steps 7 and 8 until you have captured and accepted all of the views for the rest stage.
10. Press the **END** softkey after all images from the required views have been captured and accepted. The image collection for the first view appears.

11. Use the trackball to position the cursor on the image that you want to store as the “Best Beat” image for the view.
12. Press the **SELECT** control. The image is selected, as indicated by the outline around it. (You can select more than one image for “Best Beat” selection.)
13. Press the **STORE** softkey. The image is stored, the other images are discarded, and the system advances to the next view.
14. Repeat steps 11 through 13 until you have selected the “Best Beat” for all of the views in the rest stage. Once you have selected the “Best Beat” for each view, the image collection for the rest stage is displayed.
15. Press the **END** softkey. The post stage is initialized.

Post Stage of Two Stage Continuous Protocol

16. Immediately after the patient gets off of the treadmill, press the **TIMERS** control. The timer (**T1**) resets and begins to count the time for the post stage.
17. Acquire the first post-stage image.
18. Press the **CAPTURE** softkey to capture the image from the prescribed view. The image collection for the view appears.
19. Press the **ACCEPT** softkey to accept the image collection, or press **REJECT** to return to imaging and acquire different images for this view.
20. Repeat steps 18 and 19 until you have captured and accepted all of the views for the post stage.
21. Press the **END** softkey after all image collections from the required views have been captured and accepted. The image collection for the first view appears.
22. Use the trackball to position the cursor on the image that you want to store as the “Best Beat” image for the view.
23. Press the **SELECT** control. The image is selected, indicated by the outline around it. (You can select more than one image for “Best Beat” selection.)
24. Press the **STORE** softkey. The image is stored, the other images are discarded, and the system advances to the next view.
25. Repeat steps 22 through 24 until you have selected the “Best Beat” for all of the views in the post stage. The system displays the images for the post stage.
26. Press the **END** softkey. The system enters review, and the rest and post images are displayed side-by-side.
27. Use the **Page** keys to move through the image collection.
28. Press **REVIEW** to return to imaging.

Pharmacologic

The **Pharmacologic** acquisition protocol consists of four stages, stages 1 through 4. The following views are collected in all four stages: PLAX, PSAX, A4C, and A2C. Since all views are one beat per image and one image per view, “Best Beat” selection is unnecessary with the **Pharmacologic** acquisition protocol.

The softkeys are programmed to appear as they are needed to support the acquisition protocol. An example of the **Pharmacologic** acquisition protocol follows.

" **To use the Pharmacologic acquisition protocol:**

Stages 1 through 4 of the Pharmacologic protocol

1. Enter patient data. (If necessary, refer to “Starting an Exam” in this section.)
2. Ensure the ECG leads are properly connected and that the ECG trace is turned on and adjusted properly. See the “Physio” section.
3. Press the **PROTOCOL** control. The **Protocol Start** dialog box appears.
4. Select the protocol that you want. In this example, select **Pharmacologic**.
5. Select **Start**.
   - **Start** initiates the acquisition protocol: a momentary message prescribing the required view appears above the image. Protocol status is located in the lower right corner of the display, containing the current compression level, timer setting, stage, and view.
   - **Cancel** aborts the acquisition protocol.
   - Pressing the **PROTOCOL** control during an acquisition protocol displays the **Protocol Suspend** dialog box. You can suspend the protocol, end the protocol, or cancel the dialog box.
6. Use the trackball to position the region of interest (ROI). The ROI defines the region of the image that you are interested in capturing. Press the **SELECT** control, if necessary, to display the trackball menu and enable the ROI.
7. Press the **CAPTURE** softkey to capture the image from the prescribed view. The image collection for the view appears. The system is set up by default to **Accept Prior to Store**.
   - For each successive stage that you capture, the image for the current view and the corresponding views rom the stages already completed will appear in the collection.
8. Press the **ACCEPT** softkey to accept the image, or press **REJECT** to return to imaging and acquire a different image for this view.

9. Repeat steps 7 and 8 until you have captured and accepted all of the views for the stage.
10. Press the **END** softkey after all images from the required stage have been captured and accepted. The image collection for the views for this stage appear.
11. Press the **END** softkey. The next stage is initialized.
12. Repeat steps 6 through 11 for the remaining stages.
13. Once all of the stages are complete, the system enters review, and displays the images for each view from the four stages.
14. Use the **Page** keys to move through the image collections.
15. Press **REVIEW** to return to imaging.

Three Stage Bicycle

The **Three Stage Bicycle** acquisition protocol consists of three stages: rest, peak, and post. In the rest stage the following views are collected: PLAX, PSAX, A4C, and A2C. In the peak stage the following views are collected: A4C and A2C. In the post stage, the following views are collected: A4C, A2C, PLAX, and PSAX.

The softkeys are programmed to appear as they are needed to support the acquisition protocol. An example of the **Three Stage Bicycle** acquisition protocol follows.

" **To use the Three Stage Bicycle acquisition protocol:**

Rest Stage

1. Enter patient data. (If necessary, refer to “Starting an Exam” in this section.)
2. Ensure the ECG leads are properly connected and that the ECG trace is turned on and adjusted properly. See the “Physio” section.
3. Press the **PROTOCOL** control. The **Protocol Start** dialog box appears.
4. Select the protocol that you want. In this example, select **Three Stage Bicycle**.
5. Select **Start**.
   - **Start** initiates the acquisition protocol: a momentary message prescribing the required view appears above the image. Protocol status is located in the lower right corner of the display, containing the current compression level, timer setting, stage, and view.
   - **Cancel** aborts the acquisition protocol.
   - Pressing the **PROTOCOL** control during an acquisition protocol displays the **Protocol Suspend** dialog box. You can suspend the protocol, end the protocol, or cancel the dialog box.

6. Use the trackball to position the region of interest. The region of interest defines the region of the image that you are interested in capturing. (Press the **SELECT** control, if necessary, to display the trackball menu and enable ROI.)
7. Press the **CAPTURE** softkey to capture the image from the prescribed view.
8. Press the **ACCEPT** softkey to accept the image collection, or press **REJECT** to return to imaging and acquire different images for this view. The system is set up by default to **Accept Prior to Store**.
9. You can use the **VIEW>** or **VIEW<** softkeys to return to a previous view or advance to the next view.
10. Press the **END** softkey when the system prompts that all images have been captured and accepted. The system initializes views for the peak stage**.**

Peak Stage

11. Immediately after the patient gets off of the bicycle, press the **TIMERS** control. The timer (**T1**) begins to count the time after the cessation of exercise.
12. Acquire the first peak-stage image.
13. Press the **CAPTURE** softkey. The image is captured, and a heart beat counter appears on the left side of the display. The counter displays the current number of beats recorded in full disclosure and the total number of beats that can be stored (for example: 2 of 256).
14. Continue to acquire the peak stage images.
    - Press the **PAUSE** softkey to interrupt the peak stage. (Use **PAUSE** if you want to change system control settings that affect image scaling.)
15. Press the **DONE** softkey after all images from the required views have been captured. The system automatically initializes for post stage. (Images are stored until “Best Beat” selection, which occurs after the post stage images have been captured.

Post Stage

16. Acquire the first post-stage image.
17. Press the **CAPTURE** softkey. The image is captured, and a heart beat counter appears on the left side of the display. The counter displays the current number of beats recorded in full disclosure and the total number of beats that can be stored (for example: 2 of 256).
18. Continue to acquire the post stage images.
    - Press the **PAUSE** softkey to interrupt the post stage. (Use **PAUSE** if you want to change system control settings that affect image scaling.)

19. Press the **DONE** softkey after all images from the required views have been captured. The system automatically enters “Best Beat” selection.
20. Use the trackball and the **SELECT** control to make the “Best Beat” selections. An image is selected, when it is outlined. (You can select more than one image for “Best Beat” selection.)
21. Press the **STORE** softkey. The image is stored and another collection of images is displayed.
22. Repeat steps 20 and 21 until you have stored the required images and the “Best Beat” image from each view for the peak stage.
23. Press the **END** softkey when you are finished selecting the “Best Beat” images for the peak stage.
24. Repeat steps 20 and 21 until all images have been stored for the post stage.
25. Press the **END** softkey when you are finished selecting the “Best Beat” images for the peak and post stages. The system enters review, and displays the images for each view from the three stages and any additional images selected during “Best Beat” selection.
26. Use the **Page** keys to move through the image collections.
27. Press the **REVIEW** control to return to imaging.

Digital Echo

The **Digital Echo** acquisition protocol consists of a routine study in which a number of images from several imaging modes can be captured. The **Digital Echo** protocol is not intended for stress echocardiography.

The softkeys are programmed to appear as they are needed to support the acquisition protocol.

" **To use the Digital Echo acquisition protocol:**

Routine Stage

1. Enter patient data. (If necessary, refer to “Starting an Exam” in this section.)
2. Ensure the ECG leads are properly connected and that the ECG trace is turned on and adjusted properly. See the “Physio” section.
3. Select **Digital Echo**. The **Protocol Start** dialog box appears.
4. Select **Start**.
   - **Start** initiates the acquisition protocol: a momentary message prescribing the required view appears above the image. Protocol status is located in the lower

right corner of the display, containing the current compression level, timer setting, stage, and view.

- **Cancel** aborts the acquisition protocol.
- Pressing the **PROTOCOL** control during an acquisition protocol displays the **Protocol Suspend** dialog box. You can suspend the protocol, end the protocol, or cancel the dialog box.

5. Press the **CAPTURE** softkey to capture the image from the prescribed view. The system is set up by default to **Accept Prior to Store**.
6. Press the **ACCEPT** softkey to accept the image, or press **REJECT** to return to imaging and acquire a different image for this view.
7. Repeat steps 5 and 6 until you have captured and accepted all of the views for the stage.
8. Press the **END** softkey after all images from the stage have been captured and accepted.
9. The system enters review and displays the first image captured for the routine stage.
10. Use the **Page** keys to move through the images for the routine stage.
11. Press **REVIEW** to return to imaging.

Review

You can review patient files by selecting **Load** in the **Patient Directory**. You can also review the active study by pressing the **REVIEW** control. During an active acquisition protocol, you must suspend the protocol before you can perform the image review. You must copy patient files on an optical disk to the hard disk before you can review them. The following procedures provide examples of how image review works, including the page, graphics, and toolbar functions.

" **To review images:**

Image review is not available during an acquisition protocol (you must suspend the protocol), “Best Beat” selection, or “Accept Prior to Store” selection. At the end of an acquisition protocol, the system automatically enters image review; to return to imaging, press the **REVIEW** control.

1. Suspend the acquisition protocol, if necessary:
   a. Press the **PROTOCOL** control. The **Protocol Suspend** dialog box appears.
   b. Select **Suspend**. The acquisition protocol is suspended. (To resume the acquisition protocol, repeat step a, and then select **Resume** from the **Protocol Resume** dialog box.)

2. Press the **REVIEW** control. The image display that appears is dependent upon the capture format (single, dual, or quad image format).
3. Press the **Page** keys to display collections of review images.
4. Select the streaming icon (the icon turns white) to stream the acquired clip from the hard disk to the display for review.
   - Only one image can be streamed from the disk for any given collection.
   - The first cardiac clip of each image is displayed when there is ECG information available.
   - The first 30 frames of each image is displayed when no ECG information is available.
5. Press the **TOOLBAR** control. The toolbar appears at the bottom of the screen (Figure 10–19).
   a. Select an image on which to use the tool.
   b. Move the cursor over the selections on the toolbar to display the function of the tool.
   c. Use a tool to perform a function on the selected image.
   d. Select the **Label** tool. The **Label** toolbar appears (Figure 10–20).
   e. Use the tools on the **Label** toolbar to perform a function on the selected image.
6. Press the **TOOLBAR** control. The toolbar is removed.
7. Press the **Superkey** and the **Graphics** key to remove the graphics from the review images. (Press the **Superkey** and the **Graphics** key again to display the graphics.)
8. Press the **REVIEW** control to return to imaging.

" **To review images from a previous study:**

1. Press the **NET/DISK MENU** control. The **Net/Disk** menu appears.
2. Select **Directory**. The **Patient Directory** appears (Figure 10–17).

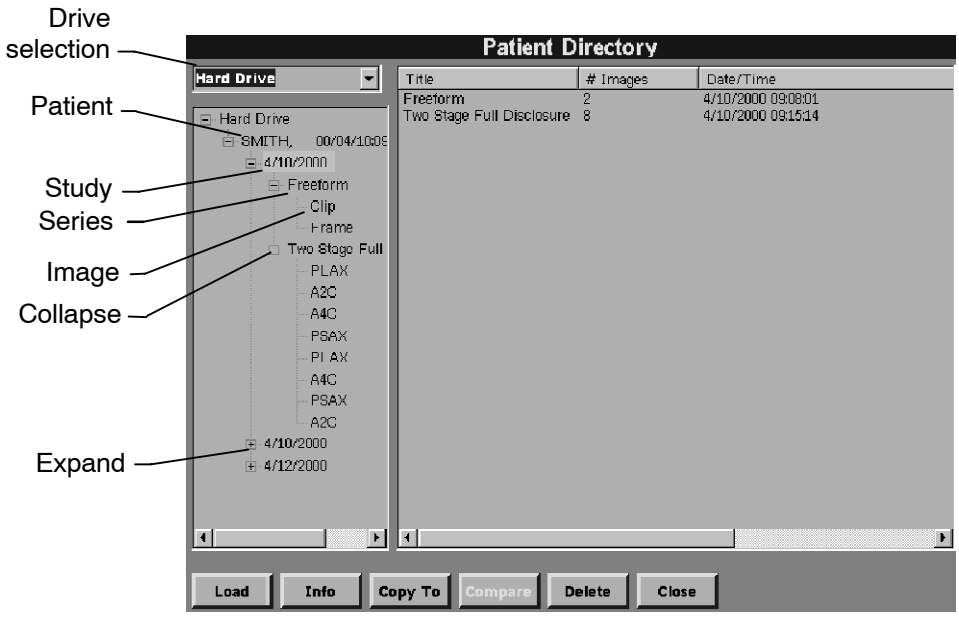


Figure 10–17. Patient Directory

3. Select the patient, study, stage, or view that you want to review. (Before you can review images on the optical disk, the images must be copied to the hard disk.)
4. Select **Load**. The images are loaded and review begins.
5. Press the **Page** keys to display collections of review images.
6. Select the streaming icon to stream the acquired clip from the hard disk to the display for review.
   - Only one image can be streamed from the disk for any given collection.
   - The first cardiac clip of each image is displayed when there is ECG information available.
   - The first 30 frames of each image is displayed when no ECG information is available.
7. Press the **TOOLBAR** control. The toolbar appears at the bottom of the screen.
   a. Select an image or images on which to use the tool.
   b. Move the cursor over the selections on the toolbar to display the function of the tool.

c. Use a tool to perform a function on the selected image or images.

d. Select the **Label** tool. The **Label** toolbar appears.

e. Use the tools on the **Label** toolbar to perform a function on the selected image.

8. Press the **TOOLBAR** control. The toolbar is removed.
9. Press the **Superkey** and the **Graphics** key to remove the graphics from the review images. (Press the **Superkey** and the **Graphics** key again to display the graphics.)
10. Press the **REVIEW** control to return to imaging.

" **To delete a review image:**

1. In review, select the image or images to delete.
2. Press the **DEL IMG** control. A **Delete Images** dialog box appears, indicating the number of images that you are deleting from the displayed collection (Figure 10–18).
3. Select **OK** to delete the images, or select **Cancel** to abort the deletion.

Figure 10–18. Delete Images Dialog Box

" **To measure a review image:**

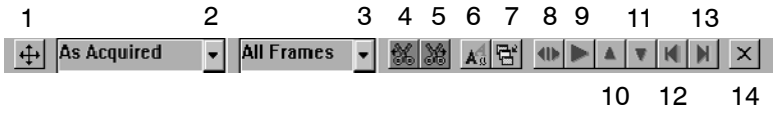
Only one image can be selected for measurement. All review images must be calibrated before a measurement can be performed. To allow for accurate calibration, all user annotation will be cleared from review images when measurements are performed.

1. Press **REVIEW**. The system displays the review images in single, dual, or quad format.
2. Select one image to measure. Selection is indicated by the outline around the image.

3. Press **DISTANCE**, **AREA**, **CALCS**, or **ADV MEAS** to start the measurement. The **Select Display** dialog box appears.
   - Select **Accept** if the existing calibration is accurate for the displayed image.
   - Select **Calibrate** if a new calibration is required, and perform the calibration as indicated by the system prompts.
4. Perform the measurement. If necessary, refer to “Making Measurements” in *Getting Started* and “Measurements” in this manual.
5. Press **REVIEW** to return to the review images screen. (If desired, press **REVIEW** again to return to imaging.

Toolbar

During image review, pressing the **TOOLBAR** control displays a toolbar (Figure 10–19). The toolbar consists of several image manipulation tools. When you move the cursor over a tool, a label appears, denoting the function of the tool. All of the tools are explained in the glossary.



See Table 10–1 for functions.

Figure 10–19. Toolbar

Table 10–1. Toolbar Functions

	Toolbar Functions
1	Move icon moves and anchors the toolbar on the display.
2	Displays the play drop-down list. Includes As Acquired and All Cycles.
3	With dual or quad formats, displays the auto trim drop-down list, which is used with the play drop-down list to select the type of image play.
4	Trim first icon is used to trim first frame clip.
5	Trim last icon is used to trim last frames from a clip.
6	Label icon displays the Label toolbar (see Table 10–2).
7	Mix/Match icon is used to create new collections from existing collections of images.
8	Previous icon is used to step backward through a clip.
9	Next icon is used to step forward through a clip.
10	Scroll icon is used enable the trackball, which can be used to scroll through a clip.
11	Play/pause icon is used to start and stop clip playback.
12	Play faster icon speeds up the clip playback.
13	Play slower icon slows down the clip playback.
14	Close icon closes the collection.

If you select the **Label** icon on the toolbar, a **Label** toolbar appears (Figure 10–20). Using the **Label** toolbar, you can apply the protocol, stage, and view labels to stored images. Selecting **Apply** saves the stage and view labels. Selecting the **Cancel** icon, removes the **Label** toolbar.

See Table 10–2 for functions.

Figure 10–20. Toolbar and Label Toolbar

Table 10–2. Label Toolbar Functions

	Label Toolbar Functions
1	Move icon moves and anchors the Label toolbar on the display.
2	Protocol drop-down list.
3	Stage drop-down list.
4	View drop-down list.
5	Apply icon assigns the labels selected in the protocol, stage, and view drop-down lists to the selected image.
6	Cancel icon removes the Label toolbar.

Patient Directory and File Management

The patient directory contains patient files. At the top of the patient directory, you can use the drive-selection drop-down list to select the hard drive or the optical disk to view the directories for those sources. At the bottom of the patient directory are selections with which you can perform the following:

- Load patient files for review.
- Display patient, study, series, or image information.
- Copy patient files between the hard disk and the optical disk.
- Delete patient files from the patient directory.
- Close the patient directory.

" **To load a patient file from the patient directory for review:**

1. Press the **NET/DISK** control. The **Net/Disk** menu appears.
2. Select **Directory**. The **Patient Directory** appears (Figure 10–21).

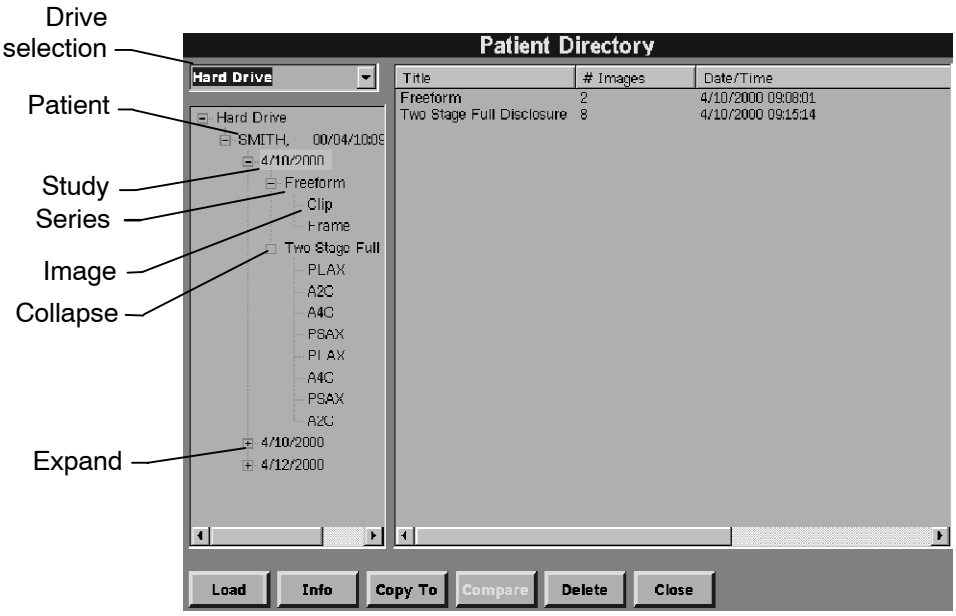


Figure 10–21. Patient Directory

3. Select the drive-selection drop-down list to display the **Hard Disk** or **Optical** selection. A patient directory for the hard disk or the optical disk appears.
4. Select the expand icon (+) for a patient, study, series, acquisition protocol, view, or image (frame, clip). The selection expands in the left side of the patient directory based on your level of selection. (Selecting the collapse icon (–) collapses the selection.)
5. Select an item in the right side of the patient directory. The right side of the patient directory reflects pertinent information about your selection. For example: the title, number (#) of images in the series, and the date and time of the series.

" **To display information for a patient, study, series, or image:**

1. In the patient directory, select a patient, study, series, or image.
2. Select **Info**. The following appears, based on your selection:

- If you selected a patient name, the **Patient Information** dialog box appears (Figure 10–22).
- If you selected a study, the **Study Information** dialog box appears (Figure 10–23).
- If you selected a series (freeform or acquisition protocol), the **Series Information** dialog box appears (Figure 10–24).
- If you selected an image (frame, clip, or view), the **Image Information** dialog box appears (Figure 10–25).

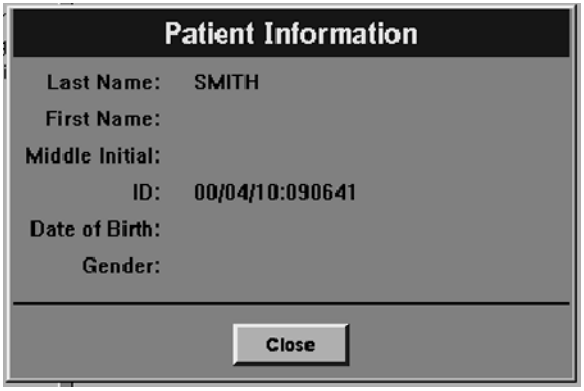


Figure 10–22. Patient Information Dialog Box

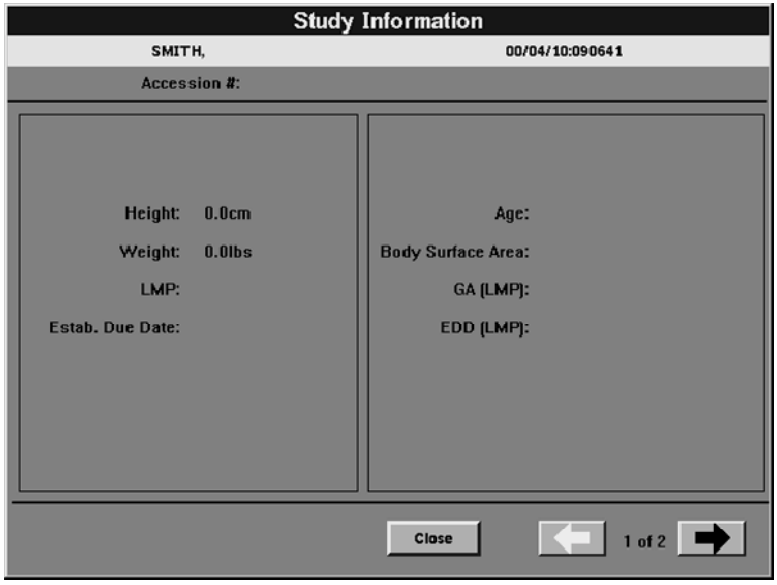


Figure 10–23. Study Information Dialog Box

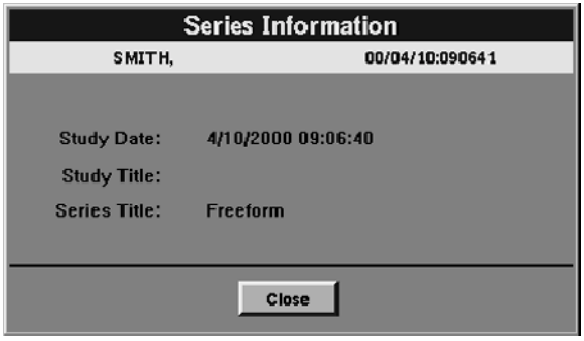


Figure 10–24. Series Information Dialog Box

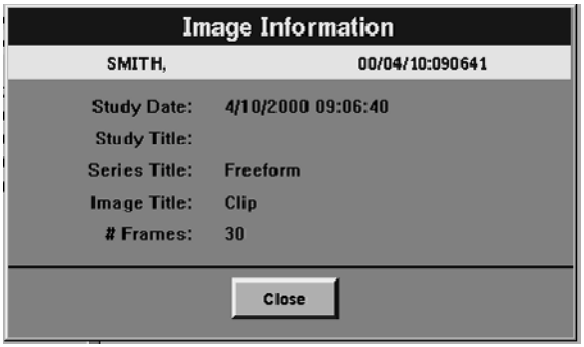


Figure 10–25. Image Information Dialog Box

" **To copy patient files:**

1. In the patient directory, select a patient, study, series, or image.
2. Ensure a formatted optical disk is installed. You must use an optical disk formatted in the optical disk drive shown in Figure 10–1.
3. Select **Copy To**. The **Copy To** dialog box appears (Figure 10–26).
4. Select **OK**. The selection is copied to the destination disk. A message appears at the top of the display “The Copy Operation is Completed.”

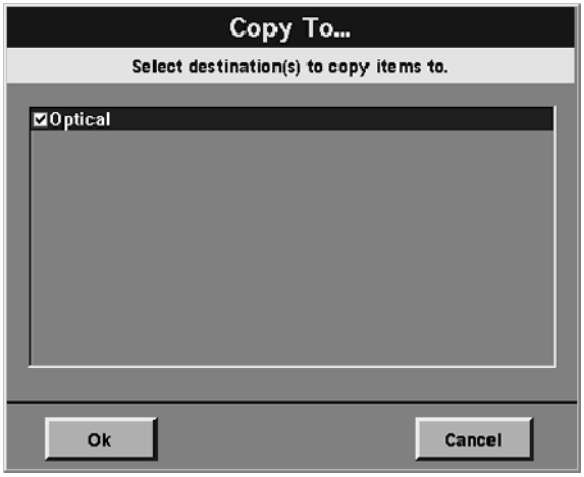


Figure 10–26. Copy To Dialog Box

" **To delete patient files:**

1. In the patient directory, select the patient, study, series, or image.
2. Select **Delete**. A dialog box appears stating the number items being deleted and requiring confirmation (Figure 10–27).
3. Select **OK** to confirm deletion. The items are deleted and the patient directory reflects the deletion.

Figure 10–27. Delete Dialog Box

" **To close the patient directory:**

In the patient directory, select **Close**.

DVS Hand Controller

The DVS hand controller connects to the rear of the control panel.You can use the hand controller to perform the following functions:

- The top three controls correspond to the top three softkey controls. When the VCR controls are mapped to the softkeys, the hand controller does not display the VCR functions, but the top control on the hand controller will play the VCR.
- **PROTO** displays the **Protocol Start** dialog box.
- **TIMER** starts and resets the timers. (Performs the same function as the **TIMERS** control.)
- **PARAM** displays the **Exam Parameters** dialog box.
- **PRINT** stores an image to the hard disk.
- **FREEZE** freezes the image.
- The trackball moves objects on the display.

- **SELECT** initiates an action or enables a control. Also allows you to select a trackball option from the trackball selection menu, which briefly appears above the image display.
- **<PAGE** pages back through the images.
- **>PAGE** pages forward through the images.
- The bottom five controls do not work at this time.

Printing and Recording

Do not attempt to frame-grab a DVS image.

Do not initiate VCR play while in setups; the VCR will not respond.

" **To print a hardcopy:**

Press the **Superkey** and the **Print Local** key.

Footswitch

After you start an acquisition protocol, the three pedals (from left to right) on the footswitch assume the same functions as the top three softkeys. The left footswitch pedal corresponds to the top softkey, the middle pedal to the second softkey, and the right pedal to the third softkey from the top.

Setups

Acquisition Parameters

You can change the acquisition parameters for frames, clips, and protocols. You can also create your own user-defined acquisition protocols. You cannot change the system acquisition protocols.

" **To change the acquisition parameters:**

You can also press the **PARAMS** control and change some acquisition parameters using the **Exam Parameters** dialog box.

1. Press **Setups**. The **Directory of Setup Options** appears.
2. Select **Acquisition Parameters**. The **Directory of Acquisition Parameters Setup Options** appears (Figure 10–8).
3. The **User Options** include **Configure Frame**, **Configure Clips**, and **Configure Protocol**. Select the desired user option and then configure the frame, clip, or protocol for the exam. All of the settings are explained in the glossary. To create your own acquisi-

tion protocol, refer to “User-Defined Acquisition Protocols” in this section. You cannot change the system acquisition protocols.

User-Defined Acquisition Protocols

You can define your own acquisition protocols. Using an existing acquisition protocol as a template on which to construct your own protocol is a convenient way to do this. You first need to see how the existing acquisition protocols are constructed by looking at the **Acquisition Parameters** setups. These setups include the parameters that define protocol behavior. Once you have reviewed these parameters, you can copy an existing acquisition protocol and change it to meet your special needs. You can also start with a new protocol. All of the parameters are defined in the glossary. An example of defining an acquisition protocol follows.

" **To create a user-defined acquisition protocol:**

1. Press **Setups**. The **Directory of Setup Options** appears.
2. Select **Acquisition Parameters**. The **Directory of Acquisition Parameters Setup Options** appears.
3. Select **Configure Protocol**. The **Configure Protocol** display appears (Figure 10–28).

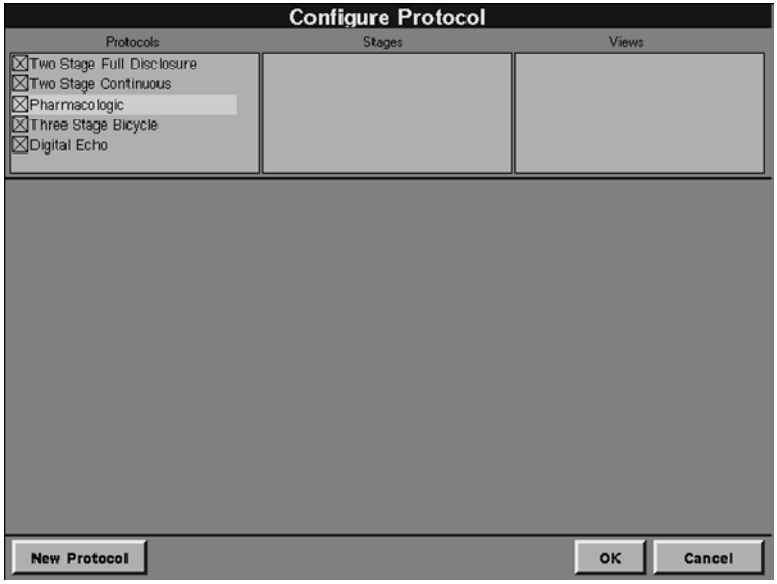


Figure 10–28. Configure Protocol

4. Highlight a protocol that is similar to the one you want to create, or select **New Protocol**.
5. If you highlighted an existing protocol as a template, select **Copy Protocol**; otherwise, continue with step 6.
6. A new protocol appears in the **Protocols** list, and **New Protocol n** (where n is a number) appears in the **Protocols** list (Figure 10–29).

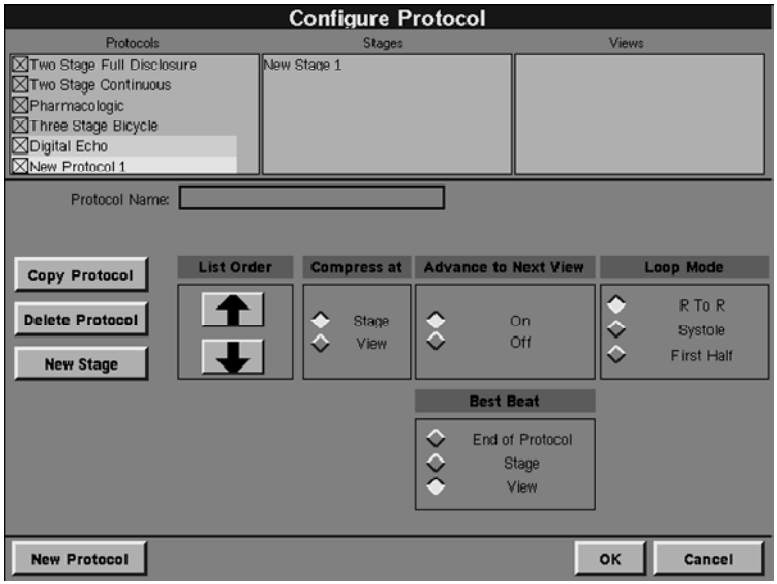


Figure 10–29. Protocol Name Field

7. Use the trackball to move the cursor to the **Protocol Name** field.
8. Use the keyboard to enter the name you want. When you move the cursor outside the **Protocol Name** field, the **Protocols** list is updated with the new name.
9. Select values for the **List Order**, **Compress at**, **Advance to Next View**, **Loop Mode**, and **Best Beat** parameters.
10. Select **New Stage**. **New Stage n** appears in the **Stages** list.
11. Use the trackball to move the cursor to the **Stage Name** field.
12. Use the keyboard to enter the name you want. When you move the cursor outside the **Stage Name** field, the **Stages** list is updated with the new name.
13. Select values for the **List Order**, **Accept Prior to Store**, **Capture Mode**, and **Compression Type** parameters (Figure 10–30).

14. Repeat steps 10 through 13 to create additional stages.

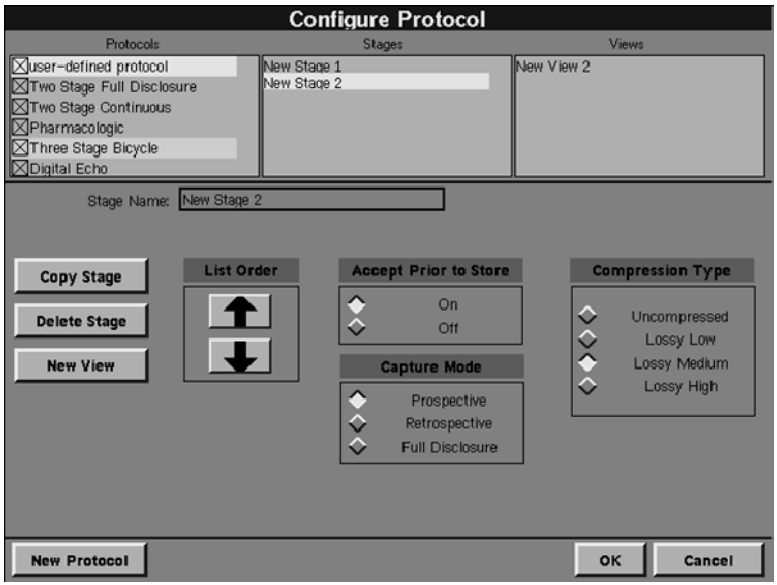


Figure 10–30. Setting Stage Parameters

15. Select **New View**. **New View n** appears in the **Views** list.
16. Use the trackball to move the cursor to the **View Name** field.
17. Use the keyboard to enter the **View Name**. When you move the cursor outside the **View Name** field, the **View** list is updated with the new name.
18. Use the keyboard to enter the prompt you want to appear during the protocol for the view you just created.
19. Select values for the **List Order**, **Capture Format**, **Capture Length**, **Compression Type**, and **ECG Trigger** parameters (Figure 10–31).

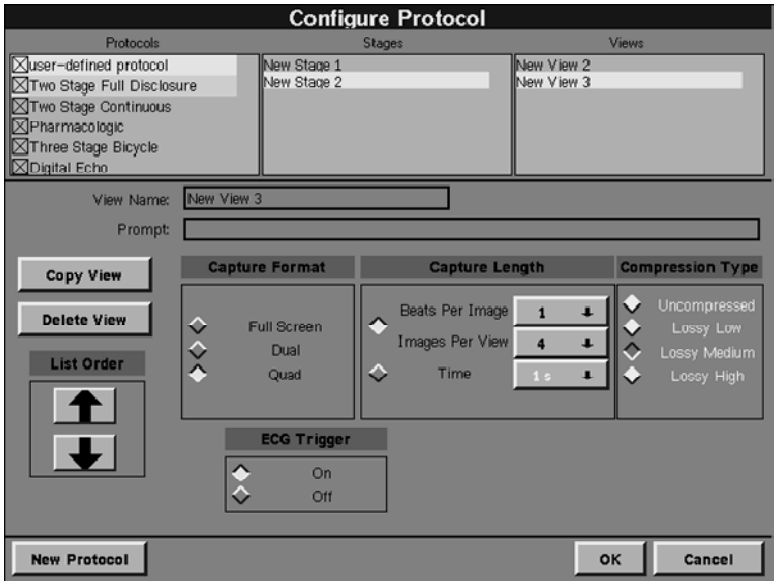


Figure 10–31. Setting View Parameters

20. Repeat steps 15 through 19 to create additional views.
21. Once you have finished selecting the values for the acquisition parameters, verify that the name of your protocol appears in the **Protocols** list.
22. Select **OK** to store the user-defined acquisition protocol and return to the **Directory of Acquisition Parameters Setup Options**.
23. Select **Close** to return to imaging.
24. Press the **PROTOCOL** control. Verify that your acquisition protocol appears in the list of protocols in the **Start Protocol** dialog box (Figure 10–32).

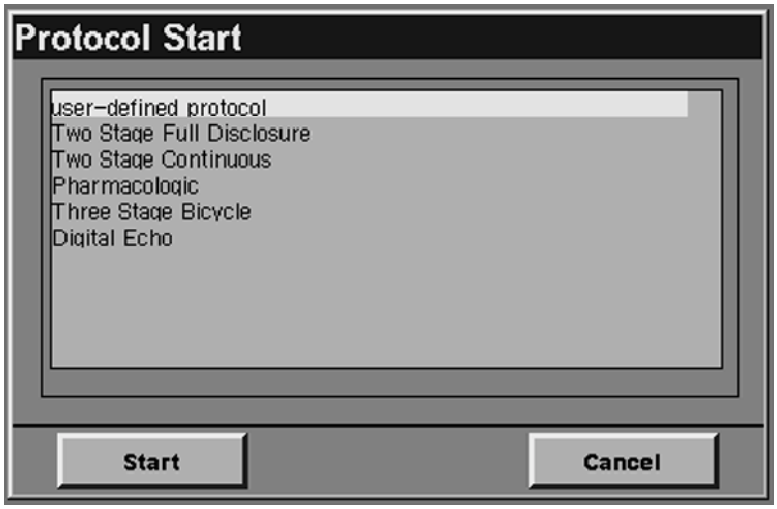


Figure 10–32. Start Protocol Dialog Box

Image Management Setups

General Options

There are two setups in the General Options setups: **Number of Timers** and **Operator Prompts.** There are three timers available. The **Timers** setup in the **Image Management General Options** setups lets you set the number of timers. Pressing the **TIMERS** control starts the active timer. You can enable operator prompts associated with the acquisition protocols or disable them, using the **Operator Prompts** setup.

Modify Study Data List

Study data is available from the **Patient Data Entry** form. The study data list consists of the following information: Indications, Medications, Previous Surgeries, Referring Physician, Reading Physician, Sonographer, and Study Title. You can modify the study data lists from the **Image Management** setups. The Referring Physician, Reading Physician, Sonographer, and Study Title can be modified using the following procedure.

" **To modify the study data list:**

1. Press the **Setups** key. The **Directory of Setup Options** appears.
2. Select **Image Management**. The **Directory of Image Management Setup Options** appears.
3. Select **Modify Study Data Lists**. The **Study Data List Modifier** appears (Figure 10–33).

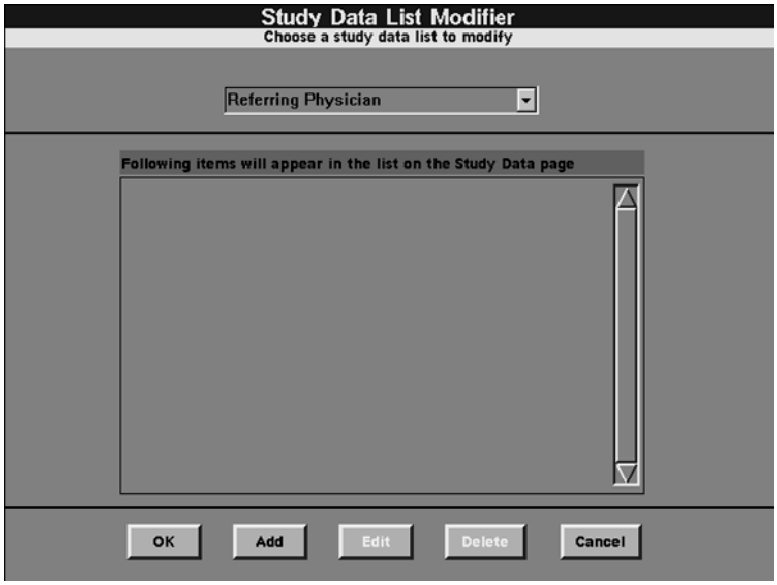


Figure 10–33. Study Data List Modifier

4. Select the study data item you want from the drop-down list at the top of the display.
5. Select **Add**. The **Add List Item** dialog box appears (Figure 10–34).

Figure 10–34. Add List Item Dialog Box

6. Use the keyboard to enter the data into the **List Item** field.
7. Select **OK**. The data that you entered into the **List Item** field will appear in the list on the **Study Data** page.
8. Repeat steps 4 through 7 as needed to modify the study data list.
9. Select an item in the list (items must exist in the list before they can be edited or deleted). The **Edit** and **Delete** selections are enabled.

10. Select **Edit**. The **Edit List Item** dialog box appears (Figure 10–35).

Figure 10–35. Edit List Item Dialog Box

11. Use the keyboard to edit the list item.
12. Select **OK**. The edited data appears in the list.
13. Select an item in the list.
14. Select **Delete**. The item is deleted from the list.
15. Select **OK** to close the **Study Data List Modifier**. (Selecting **Cancel** will result in no change to the study data lists.)
16. Select **Close** to return to imaging.
17. Press the **Patient Data** key. The **Patient Data Entry** display appears.
18. Select **Study Data,** and display **Study Data 2 of 2** by selecting the right arrow (Figure 10–36).

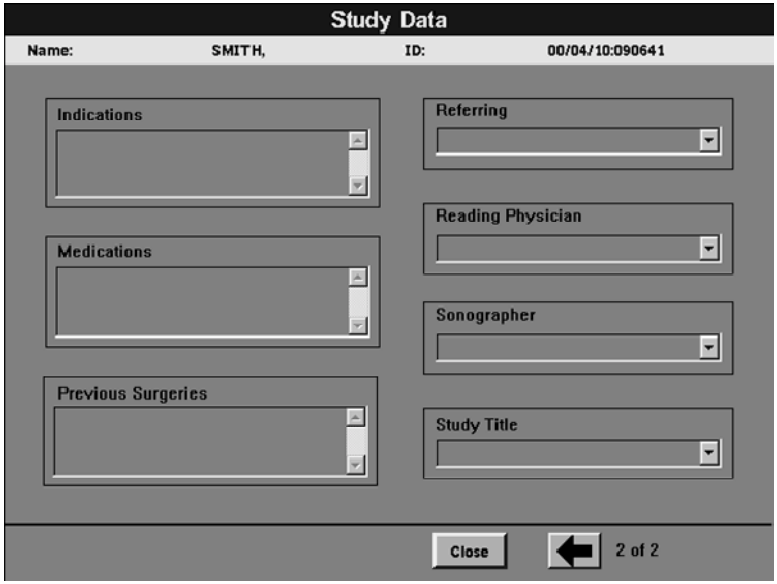


Figure 10–36. Study Data

19. For each study data item, select the item that you want for the current patient from the drop-down list. (You can also use the keyboard to enter text into the study data.)
20. Use the keyboard to enter data into the **Indications**, **Medications**, and **Previous Surgeries** data fields.
21. Select **Close**, or press the **Patient Data** key.

Peripherals Setups

The **VCR & Hardcopy Source** setup has two settings: **Live Image** and **On-Screen Video**. Selecting **Live Image** directs the system video to the VCR and the internal hardcopy device. Selecting **On-Screen Video** directs the video from the DVS option to the VCR and the internal hardcopy device. See the "Printing and Recording" section for additional information.

If you change the **VCR & Hardcopy Source** setup, the change does not take effect until the next image capture or the next time you cycle system power.

Maintenance

Maintenance should be performed as needed. Contact your ATL Customer Service representative for more information.

Ultrasound System

WARNING

Always turn the system to **STANDBY**, set the circuit breaker to **OFF**, and then disconnect the system from the wall outlet before performing maintenance or cleaning.

CAUTION

Do not use strong solvents such as thinner or benzine, or abrasive cleansers, because these will damage the cabinet.

Cleaning

Periodically, clean all exterior surfaces of the system using a soft cloth moistened with a mild detergent solution.

When cleaning the system keyboard and monitor, take care not to get any solution inside the housings. Also take care not to scratch the face of the monitor while cleaning it.

Air Filter

The system air filter should be inspected every week and cleaned as needed. The air filter is located in a slot at the bottom front of the system. Depending on the condition of the air filter, you can use a vacuum cleaner or soap and water to clean it. A spare air filter is included with the system. If you decide to clean the air filter with soap and water, you may want to use the spare while the other air filter dries. Additional air filters can be ordered from ATL Customer Service.

CAUTION

Turn off power before you remove the air filter. Do not turn power on without an air filter installed.

DVS Hand Controller and Footswitch

Periodically, clean all exterior surfaces using a soft cloth moistened with a mild detergent solution. Take care not to get any solution inside the housings.

Scanheads

Refer to *Using Disinfectants and Gels* for all information regarding scanhead cleaning and disinfection and the use of acoustic coupling gels.

Printers

WARNING

Prior to performing any maintenance on a device, always disconnect it from the source of power by either of the following: disconnect the system from the wall outlet if the device is internal to the system; or disconnect the device from the wall outlet if it is external to the system.

CAUTION

Do not scratch the roller or allow dirt and dust to contact the roller of a printer.

Care of the Printer Cabinet

CAUTION

Do not use strong solvents such as thinner or benzine, or abrasive cleaners, since these will damage a device cabinet.

Periodically clean the external surfaces of a device with a soft cloth. Stubborn stains may be removed with a cloth lightly dampened with a mild detergent solution.

VCR

CAUTIONS

- Do not insert a videotape before the system has completed the initialization/ warm-up phase.
- Do not move the ultrasound system with the videotape cassette in the VCR. Damage to the VCR may result.
- Do not use commercial head cleaning products on the VCR. These products may damage the recording heads. All maintenance should be performed by an ATL Customer Support Representative.
- Do not make adjustments to your VCR. Consult an ATL Customer Service representative for repair or maintenance of your VCR.

Periodically clean the external surfaces of a device with a soft cloth. Stubborn stains may be removed with a cloth lightly dampened with a mild detergent solution.

Troubleshooting

If you encounter difficulty in the operation of the system, use the information in this section to help correct the problem. If the problem is not covered here, contact your Customer Service representative.

Using the Troubleshooting Table

The troubleshooting table contains a list of symptoms and the action to take to correct the problem (Table 12–1).

Error Messages

The system also displays error messages on the system video monitor in response to operating or error conditions detected by the system. The error messages contain 20-digit error codes that must be noted and reported to your Customer Service representative. Do not use the system if an error code is displayed. Call your Customer Service representative and report the error code.

Diagnostics

The system has a sophisticated diagnostics capability. The use of the Diagnostics is described in the “Setups” section.

Diagnostic Alerts

Write down the information displayed on the yellow diagnostic alert, turn off the system, and call your Customer Service representative. Do not use the system until your representative says that it is okay to do so. An example of a yellow diagnostic alert follows.

Write down the information displayed on the blue run-time alert, turn power off and then back on, and resume scanning. Call your Customer Service representative as soon as you can, and provide the information from the blue run-time alert to your representative. An example of a blue run-time alert follows.

System Diagnostics Alert (yellow)
A System Diagnostics error has been detected. **Please record the following information and call ATL Technical Support.** **System module name reporting communication error during Bootup appears here.** **(A 20-digit code is reported in this area.)** **Ensure that you note the type of alert, module name, and the 20-digit code.**

Run-time Alert (blue)
A run-time error has been detected. **Please record the following information and call ATL Technical Support.** **System module name reporting communication error during the operating mode appears here.** **(The 20-digit code is reported in this area.)** **Ensure that you note the type of alert, module name, and the 20-digit code.**

For Assistance

If you are unable to correct a problem, call your local Customer Service representative.

Table 12–1. Troubleshooting Table

Category	Symptom	Corrective Action
System Controls	System does not power up.	Ensure that the system is plugged in to a grounded outlet, and that the circuit breaker on the rear of the main chassis is set to **ON**. Turn the **ON/STANDBY** switch **ON**.
	System powers up, but the video display is blank.	(1) Adjust the **BRIGHTNESS** and **CONTRAST** controls on the system video monitor. (2) Ensure the 120VAC power cord and the video cables provided for the monitor are connected to it.
	Hardcopy device does not print.	(1) Verify that the active hardcopy device is selected in **Peripheral s**etups. (2) Ensure that the video and power cords are connected to the hardcopy device. (3) Ensure that the hardcopy device power switch is **ON**.
	Incorrect time and date.	Press the **Setups** key and enter the correct time and date. See “Setups” section.
	No audio.	(1) Adjust the **VOLUME** control. (2) Turn on speakers in the **Peripherals s**etups. See “Setups” section.

Table 12–1. Troubleshooting Table (Continued)

Category	Symptom	Corrective Action
VCR	Cannot insert video cassette.	(1) Verify video cassette orientation and try to insert the video cassette again. (2) Ensure that there is not already a video cassette in the VCR. (3) Ensure the VCR is turned on.
	With SVHS VCR, the video cassette is not properly drawn into the VCR by the VCR after inserting the cassette into the slot.	Physically guide the video cassette into the VCR slot.
	Cannot record.	Verify the condition of the video cassette write-protect tab.
	Poor playback image quality.	The videotape may be worn. Replace the video cassette.
2D	2D echoes in cystic structures.	Adjust the frame rate.
	Lack of penetration or sensitivity.	Select correct scanhead.
Doppler	Mirroring in the Doppler display.	Decrease **DOP GAIN**.
	Aliasing in the Doppler display.	Increase the velocity range with the **SCALE** control or change baseline with the **BASELINE** control.
	Wall filter changes without changing the Filter control.	Normal. The wall filter is tied to the Doppler PRF, and the system will automatically adjust the wall filter based on changes in PRF.
Color	Loss of color data.	Decrease **2D GAIN**.
	No color.	Increase **COL GAIN**.
	Some Color control settings are not displayed.	Turn on **Image Info** in **Display** setups.
	Misplaced color (color displayed on heart wall).	Choose proper **PRIORITY** setting.
ECG/Physio	ECG triggers do not update.	Press the **UPDATE** control.

Table 12–1. Troubleshooting Table (Continued)

Category	Symptom	Corrective Action
	No ECG/Physio display.	(1) Verify **Physio** setups. (2) Verify Physio connections.
	No pulse or phono display.	(1) Verify that ECG is on. (2) Verify that **Hide/Show** is set to **Show**. (3) Verify that **ChA/ChB** is configured correctly.
Cannot store to optical disk.	Optical disk not installed.	Install and format an optical disk.
	Optical disk full.	Remove the optical disk and install another.
Unable to spool an image to the optical disk.	Data transfer error between hard disk and optical disk.	Install a new, formatted optical disk, and copy the exam from the hard disk to the optical disk.
	Not enough memory remaining on the disk.	Install a new, formatted optical disk, and copy the exam from the hard disk to the optical disk.
Cannot store images to hard disk.	More than 150 patient files listed in the hard disk exam directory.	Archive patient exams to an optical disk, or delete patient exams to make room for added patient exams.
Unable to select a printer setup.	The printer setup is invalid for the setups already selected: some printer settings create dependencies.	Try selecting a different setup.
A printer is not listed in the **Printers** setups.	The printer is the last one listed in the **Host Table** and the entry is not followed by a **Return**.	Display the **Host Table** and add a **Return** after the last **ImagePrinters** entry.

Table 12–1. Troubleshooting Table (Continued)

Category	Symptom	Corrective Action
Unable to delete an image.	Image has been spooled to the optical disk or to the network archive device.	Images spooled to these devices cannot be deleted.
Unable to edit the patient name, ID, and exam type in the exam directory.	Normal operation.	Close the exam directory and change the patient data from the **Patient Data Entry** form.
Unable to select **Meas/Edit**.	Review format is not 1-on-1.	Use the trackball and move the cursor to the review format box and press the **SELECT** control.
Your changes to the Devices files no longer exist.	An upgrade has deleted your Devices files.	Redo your **Devices** files.
Images do not appear to be printed or stored.	The setup **Store Images during Exam** is set to **Store at End of Exam**.	Select **Store after Each Image**.
Images are not automatically printed or tagged for print.	The **Print Environment** is set to **Selective Print**.	Change the **Print Environment** to **Print All**.
When you attempt to print exams from the exam directory, a **No Printer** dialog appears.	There are no printers selected.	Select the appropriate printers in **Image Management: Printers** setups.
All images are being tagged for print to the black-and-white printer.	**Image Management Printer** system setup **Print Color Images to B&W Printe**r is set to Yes.	Change **"Print Color Images to B&W Printer** setup to **No**.
REVIEW control does not display Review Images from source disk.	No current patient data.	Enter patient data for the current patient, or select hard disk from **Net/ Disk Menu**.
The system appears normal, but the controls do not work.	The system is in **Review Images**.	Press the **REVIEW** control.

Table 12–1. Troubleshooting Table (Continued)

Category	Symptom	Corrective Action
PRINT control does not print a hard copy.	**Use Print Button To** system setup is set to **Store to Disk**.	Press **Setup** key and change **"Use Print Button To** in **Image Management** setups to **Print Local**.
The **PRINT** control does not seem to work.	No patient data.	Enter patient data.
A device is not listed in the **Ultrasound System Net ID** or the **Archive Devices** lists in the **Configuration Files**.	A syntax error in the host table.	Look at the host table and ensure that all syntax is correct. A common cause is the absence of a semicolon at the end of line.
A specification error is displayed on a system dialog after performing an operation on the configuration files.	A syntax error in the Host Table.	Look at the **Host Table** and ensure that all case-sensitive entries are correct (examples are the **Model ID** or the **Subnet Name**)
Device Table error message.	Upgrade fails.	**Host Table** error. Select **Proceed** to continue or **Restore** to use previous configuration files.
	Ultrasound system not included in the host table.	Check the host table and add the ultrasound system, if necessary.
Changes to the **Device** file do not exist.	A backup copy was restored and overwrote the **Device** file.	Redo the **Device** file.
Unable to edit the **Device Table**.	The **Device Table** is not editable.	Cannot edit the **Device Table**.
Error message indicating that the system IP address is not located in the configuration files.	Ultrasound system **Net ID** set incorrectly.	Check the **System Configuration** setups.

Table 12–1. Troubleshooting Table (Continued)

Category	Symptom	Corrective Action
Cannot store an image for a patient.	Number of images exceeds limit of 100 per patient file.	Create another patient file.
Unable to store an image on the hard disk.	Data transfer error between image memory and hard disk.	Reacquire the image, and attempt to store again.
Unable to send images to a printer.	Connection failure.	Verify connections between system and printer.
Unable to send images to an archive device.	Connection failure.	Verify connections and system setups for the archive device.
Restore seems to fail, but there is no apparent reason.	There is no existing backup copy.	Create a backup copy by pressing **Backup**.
A 502 error message on your Web browser.	The Web server is not turned on.	In **Image Management: System Configuration**, turn on the WebLink feature.
Print icons are not displayed.	No patient data.	Enter patient data.
Poor print quality.	Print density settings.	Adjust **Image Management Net Admin: B&W and Color Printers Printer Density** settings.
The **PRINT** control does not store images to the hard disk as expected.	**Use Print Button To, Image Management** system setup is set to **Print Local**.	Press **Setup** key and change **"Use Print Button To"** in **Image Management** setups to **Store to Disk**.

Table 12–1. Troubleshooting Table (Continued)

Category	Symptom	Corrective Action
DVS Option	DVS functions are unavailable. DVS initialization is in progress.	Wait until the timer appears in the lower right of the display.
	The power-on sequence lasts longer than expected.	The system was turned off using the circuit breaker, resulting in an extended power-on sequence. Ensure the system is put in standby with the **ON/STANDBY** control before the circuit breaker is used.
	Patient name and ID already exists on the hard drive.	Use the **Patient List** to append the patient's images.
	System will not print or store images.	Ensure patient name and ID are entered into the **Patient Data Entry** form.
	DVS initialization fails to occur.	A scanhead was selected during DVS initialization. Do not select a scanhead before DVS initializes. If scanhead select was done during DVS initialization and DVS does not initialize, cycle power.
	Characters fail to appear in the patient list.	DVS does not recognize some characters, for example, ^. Do not use these characters for patient data.
	ECG R-wave not detected error message incorrectly displayed when a measurement is attempted.	With retrospective capture, the system is ready for capture. If a measurement is attempted, the system interprets freezing the system as a detached ECG lead, and an error message occurs.

Specifications

Physical Dimensions

- Width: 72 cm (28.35 in)
- Height: 157.5 cm (62 in) with VCR
  142 cm (56 in) without VCR
  122 cm (48 in) when monitor is removed for transport
- Depth: 110.4 cm (43.45 in)
- Weight: 172–200 kg (380–440 lbs) (depends upon the hardcopy device that is installed)

System Architecture

- Digital broadband beamformer
- Extended signal processing
- Modular microcomputer structure

Imaging Modes

- Gray-scale 2D
- M-mode
- Doppler (pulsed-wave and continuous-wave)
- Power (Color Power Angio Imaging and Power Motion Imaging)
- Color 2D
- Color M-Mode
- Tissue Doppler Imaging (TDI)
- SonoCT Real-time Compound Imaging

Update Methods

- Update or Duplex
- Triple Mode
- Simultaneous

Clinical Options

- Abdomen
- Abdominal Surgery
- Adult Cardiology
- Adult Transesophageal Cardiology
- Advanced Breast Imaging
- Contrast Specific Imaging (CSI) Cardiology
- Cerebrovascular
- General Imaging Contrast
- Generic
- Gynecological and Fertility
- Musculoskeletal
- Neurosurgery
- Obstetrical
- Pediatric/Fetal Cardiology
- Pediatric
- Pediatric Transesophageal Cardiology
- Peripheral Vascular
- Prostate
- Small Parts
- Transcranial Doppler
- Vascular Surgery

Gain

- Slidepot controls for TGC with a display setup for TGC values
- 2D gain rotary control
- Doppler gain rotary control
- Color gain rotary control

Gray Shades

256 in 2D, M-mode, and Doppler

Image Processing

- 2D graymaps
- 3D CPA and grayscale displays
- Chroma maps
- Doppler graymaps
- Dynamic range
- Color maps
- CPA maps
- CPA blending
- CPA display type
- Dynamic Motion Differentiation

Scan Conversion

- Sector for phased and curved array scanheads
- Rectangular for linear array scanheads, steered for Color and Doppler imaging
- Up to 512 scan lines (scanhead dependent)

Frame Rate

- Scanhead dependent
- Frame rate control

User Control System

- Monitor brightness, contrast, lightbar, and background color controls
- Rotary controls
- Slidepot controls
- Keyboard
- Volume control
- Dedicated primary imaging controls
- Menus and superkeys for secondary imaging controls
- Color and tint controls for VCR playback
- Softkeys
- Digital Video Streaming (DVS) hand controller
- Footswitch

Digital Signal Processing

- Selectable compression (dynamic range)
- Automatic system bandwidth adjustment
- Selectable receive bandwidth patient optimization
- Software-controlled bandwidth, filter, and frequency adjustment
- SonoCT Real-time Compound Imaging
- Multiline processing

Image Modification

- Zoom and pan of real-time or frozen 2D image
- Up to eight times magnification of 2D images
- High Definition Zoom
- Up to five times M-mode zoom
- Color persistence
- 2D persistence

Programmability

- Application and scanhead optimization
- Optimization for 3D, Harmonic imaging, Frame Rate, and 2D/Color imaging
- Quick save of user settings by application and scanhead
- On-screen programming for internal and external hardcopy devices
- User-defined acquisition protocols with the DVS option
- Analysis configuration
- Annotation text

Display Annotation

- Patient name and identification
- Institution
- Time and date
- Biopsy guide line
- Title, text, arrows, scanhead position, and body marker annotation
- Tissue specific body markers
- Additional Image Information
- Image Management status
- TI and MI values
- M cursor
- Doppler sample volume and angle correction
- Graphics control with the DVS option

Image Presentation

- Up/down orientation
- Left/right orientation

2D

- Image orientation marker
- Selectable graymaps
- 2D gain control
- Up to 5 transmit focal zones
- 2D persistence
- Compression curves (Dynamic range)
- Chroma maps (gray-scale colorization)
- 2D sector size and steering
- Zoom
- HD Zoom
- 2D PRF control

3D

- Calibrated with position sensor and workstation
- Uncalibrated
- Cardiology with the MPT7–4 scanhead

M-Mode

- Four sweep speeds
- Time markers
- M-mode review
- M-mode zoom
- Three display sizes

Doppler

- Digital wall filters
- Pulsed wave (PRF range: 1.25 – 22.7 kHz)
- High PRF
- Continuous wave (Sample rate: 1.50 – 41.7 kHz)
- Adjustable sample volume (1.5 – 20 mm)
- Adjustable zero baseline
- Normal or inverted display
- Three display sizes
- Four sweep speeds
- Doppler gain control
- Doppler review
- Doppler graymaps
- Low flow capability
- Equivalent 5 MHz annotation
- High Q Automatic Doppler Results Display
- Angle correction
- Tissue Doppler Imaging for PW Doppler

Color

- 2D Color
- M-mode Color
- Color gain control
- Selectable color maps
- Velocity, variance, and power displays
- Dynamic Motion Differentiation (DMD)
- Sensitivity
- Priority threshold
- Line density
- Color persistence
- Smoothing
- Blending
- Frequency or velocity units
- Tissue Doppler Imaging for Color 2D and M-mode

Power

- 2D Color Power Angio Imaging
- 3D Color Power Angio Imaging
- Power Motion Imaging
- Selectable Power maps
- Dynamic Motion Differentiation (DMD)
- Adjustable background—on or off
- Display (Topography)
- Background (Blend)
- Dynamic Range
- Persistence
- Sensitivity
- Line Density

Physio

- ECG
- High-Level ECG
- Pulse
- Phono
- Auxiliary

Table 13–1. Physio ECG Performance Characteristics

Lower Frequency Cut-off	0.65 ± 0.06 Hz
Upper Frequency Cut-off	> 30 ± 3.0 Hz
Nominal Input Amplitude	1 mVp-p
Minimum Sensitivity	5 X 10^{-3}V

Table 13–2. Physio High Level ECG Performance Characteristics

Lower Frequency Cut-off	dc ± 0.1 Hz
Upper Frequency Cut-off	> 32 ± 3.2 Hz
Gain Range	21 dB ± 1 dB
Minimum Sensitivity	2 X 10^{-2}V

Table 13–3. Physio Pulse Performance Characteristics

Transducer Type	Fukuda Denshi	Other
Lower Frequency Cut-off	0.5 Hz ± 0.1 Hz	0.5 Hz ± 0.1 Hz
Upper Frequency Cut-off	> 50 Hz	> 50 Hz
Gain Range	45 dB ± 1 dB	35.5 dB ± 1 dB
Minimum Sensitivity	50 X 10^{-6}V	2 X 10^{-3}V

Table 13–4. Physio Auxiliary Performance Characteristics

Lower Frequency Cut-off	0.5 Hz ± 0.1 Hz
Upper Frequency Cut-off	> 800 Hz
Gain Range	28.5 dB ± 1 dB
Minimum Sensitivity	5 X 10^{-3}V

Table 13–5. Physio Phono Performance Characteristics

	Low Frequency Cut-off	Upper Frequency Cut-off	Gain Range		Minimum Sensitivity	
			Fukuda Denshi	Other	Fukuda Denshi	Other
Phono Filter: Off	28 ± 2.8 Hz	810 ± 81 Hz	51 ± 1 dB	56 ± 1dB	50 X 10^{-6}V	50 X 10^{-6}V
Phono Filter: Low	78 ± 7.8 Hz	385 ± 38.5 Hz	51 ± 1 dB	56 ± 1dB	15 X 10^{-6}V	15 X 10^{-6}V
Phono Filter: Medium	90 ± 9.0 Hz	620 ± 62 Hz	51 ± 1 dB	56 ± 1dB	15 X 10^{-6}V	15 X 10^{-6}V
Phono Filter: High	180 ± 18 Hz	800 ± 80 Hz	51 ± 1 dB	56 ± 1dB	10 X 10^{-6}V	10 X 10^{-6}V

Calculations (CALCS)

- General Imaging
- Cardiology
- Analysis Configuration (Configurable CALCS)

Measurement Tools

- Distance
- Area
- Time/slope
- Volume
- Volume Flow
- Cardiac Output
- Heart rate
- High Q set region
- High Q mean trace
- High Q peak trace
- Calibration
- Optional hip angle
- Optional d:D ratio
- Optional % diameter reduction
- Optional % area reduction

Image Storage and Retrieval

- Cineloop Image Review, 2D
- Cineloop Image Review, 3D
- Doppler Review
- M-mode Review
- Image Management Option, DEFF and DICOM compatible
- VCR Playback and Frame Grab
- Digital Video Streaming Option

Optional Hardcopy Devices

- Super VHS VCR
- Multi-Image camera
- Color page printer
- Report printer
- Black-and-white page printer

External Connections

- RGB–S (Red, Green, Blue, and Sync) video 50/60 Hz frame rate, non-interlaced for external video monitors: Sub-D 9-pin connector
- RGB–S–CB (Red, Green, Blue, Sync, and Composite Blanking) video 25/30 Hz frame rate, interlaced for external hardcopy devices: Sub-D 15-pin connector
- Composite gray scale for external hardcopy output: BNC connector
- External hardcopy device on-screen programming input: BNC connector
- VCR–S Video output: Locking S-video connector
- VCR composite video output: BNC connector
- VCR–S Video input: Locking S, video connector
- VCR composite input: BNC connector
- VCR audio output (left/right): dual RCA jacks
- VCR audio input (left/right): dual RCA jacks
- External line printer output, RS–232A: Sub-D 9-pin connector
- System diagnostic I/O (Ethernet), USD port RS–232A: Sub-D 9-pin connector (unavailable with DVS option)

Electrical and Video Parameters

- Power:
  - 100Vac, (V~), @ 50 Hz or 60 Hz, 1450 VA – NTSC
  - 120Vac, (V~), @ 60 Hz, 1450 VA – NTSC
  - 220–240Vac, (V~), @ 50 Hz, 1450 VA – PAL
  - 220–240Vac, (V~), @ 50 Hz or 60 Hz, 1450 VA – NTSC
  - Integral AC line conditioner
  - Power consumption: 800-watts; with optional OEMs, 1150 watts

Monitor

- One 15-inch, high-resolution, color monitor
- Provides a tilt and swivel adjustment
- Adjustable contrast, brightness, and lightbar controls
- Audio speakers
- Safety latches

Languages

- English
- French
- German
- Italian

Storage

- Unified cable-management system
- Gel bottle
- Footswitch
- Two general-purpose trays

Temperature, Pressure, and Humidity Limits

System Level (excluding OEMs)

- Storage and Shipping
  - High: 65°C Low: –35°C
  - All at 1060 hPa to 500 hPa (1.0 ATM to 0. 5 ATM)
  - 15% to 95% non-condensing, relative humidity
- Operating Environment
  - High: 40°C Low: 16°C:
  - All at 1060 hPa to 700 hPa (1.0 ATM to 0.7 ATM)
  - 15% to 95% non-condensing, relative humidity

Safety Requirements

- Classification:
  - Class I equipment with Type B, BF, and CF applied parts
  - Ordinary Equipment
  - Non-AP/APG
- Electromechanical safety standards met:
  - CSA C22.2 No. 601.1, Canadian Standards Association, Medical Electrical Equipment
  - EN 60601–1, Second Edition, including Amendments 1 and 2, European Norm, Medical Electrical Equipment
  - EN 60601–1–2, First Edition, European Norm, Collateral Standard, Electromagnetic Compatibility
  - IEC 1157:1992, International Electrotechnical Commission, Requirements for the declaration of the acoustic output of medical diagnostic ultrasonic equipment
  - JIS T–1000 Series, Japanese Industrial Standard, Medical Electrical Equipment
  - UL 2601–1, Underwriters Laboratories, Medical Electrical Equipment
- Agency approvals:
  - Canadian Standards Association (CSA)
  - Japanese Ministry of Health and Welfare
  - ISO 9001, EN46001 Quality Assurance Standard; Certificate #FM28256 issued by the British Standards Institution (BSI) for Quality Systems
  - CE marked to the European Community Medical Device Directive 93/42/EEC per Annex II, as a Class IIa device, in accordance with Annex IX (BSI Certificate #0604)

ATL Ultrasound reserves the right to change specifications contained herein or discontinue manufacture at any time without prior notice. Current specifications are supplied with each system purchased or are available from your ATL representative.

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Advanced Breast Imaging Clinical Option

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Cardiology Clinical Options

Table 14–1 through Table 14–3 contain the cardiology calculations for the 2D, M-mode, and Doppler protocols. The reference numbers in these tables refer to Table 14–4, which contains the references for the calculations.

Table 14–1. 2D Cardiology Protocols

Cardiology Protocol	Calculation	Reference Number (Table 14–4)
R/L Ventricle	EDV	6
	ESV	6
	EF	7
	Frac. LVD Short	7
	IVS Th Fract	2
	LVPW Th Fract	2
Ao/LA	La/Ao	4
Simpson's	Bi-plane Volume	3
	Single-plane Volume	3
	EF	7
	Stroke Volume	7
	Stroke Volume Index	7
	Cardiac Output	7
	Cardiac Index	7
LV Vol A/L	Diastolic Volume	3
	Systolic Volume	3
	EF	7
	Stroke Volume	7
	Stroke Volume Index	7
	Cardiac Output	7
	Cardiac Index	7
LV Mass	LV Mass	3
	LV Mass Index	3
LV EF	ESV	6
	EDV	6
	EF	7
	Frac. LVD Short	7

Table 14–2. M-Mode Cardiology Protocols

Cardiology Protocol	Calculation	Reference Number (Table 14–4)
R/L Ventricle	EDV	6, 9
	ESV	6, 9
	EF	7
	FS	7
	Frac. IVS Thick	2
	Frac. LVPW Thick	2
	Mean Vcf	2
	Stroke Volume	7
	Stroke Volume Index	7
	Cardiac Output	7
	LV Mass	7
	LV Mass Index	7
Mitral Valve	D-E Slope	4
Ao/LA	LV PEP/LV	4
	LA/Ao	4
Tricuspid Valve	D-E Slope	4
Pulmonic Valve	PEP/ET	4

Table 14–3. Doppler Cardiology Protocols

Cardiology Protocol	Calculation	Reference Number (Table 14–4)
Pulmonic Valve	Acc Time	7
	Peak Grad	7
MV Inflow	PVel	7
	PGr	7
	MV Area	7
	Acc Time	7
	PHT	7
MV Regurg	Area	7, 10
	Rate	7
	ERO	7
	Volume	7
LVOT	LVOT Dia	4
	PGr	5, 7
	AV Area	5, 7
Ao Valve	LVOT Dia	4
	PGr	5, 7
	AV Area	5, 7
Ao Regurg	PHT	7
TV Inflow	PVel	7
	PGrad	7
	E/A	7
	Acc Time	7

Table 14–3. Doppler Cardiology Protocols (Continued)

Cardiology Protocol	Calculation	Reference Number (Table 14–4)
TV Regurg	RVSP	7
	Area	7, 10
	Rate	7
	ERO	7
	Vol	7
Pulmonic Veins	S/D	7
CO and Qp:Qs	co(s)	7
	sv(s)	8
	co(p)	7
	sv(p)	8
	QP:QS	7
TDI	E/A	7

Table 14–4. References for Cardiology Calculations

	Reference
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General Clinical Options

Goldberg, B.B., Kurtz, A.B. “Atlas of Ultrasound Measurements.” Year Book Medical Publishers, 1990.

Obstetrical Clinical Options

Amniotic Fluid Index (AFI) Equation

Jeng, C. J., et. al. “Amniotic Fluid Index Measurement with the Four Quadrant Technique During Pregnancy.” *The Journal of Reproductive Medicine*, 35: 7, 674–677, July 1990.

Area Corrected Biparietal Diameter (BPDa) Equation

Doubilet, P., Greenes, R.“Improved Prediction of Gestational Age from Fetal Head Measurements.” *American Journal of Roentgenology*, 142: 797–800, April 1984. (Area Corrected BPD)

Fetal Doppler

This material about fetal Doppler is intended to help clinicians take into account specific considerations when performing fetal Doppler exams. We strongly recommend that users participate in formal training programs for this application before conducting a fetal Doppler exam. It is also recommended that each clinical site establish fetal Doppler protocols and normal values for their specific population to ensure uniformity of exam procedures and interpretation of results.

The system can be used to apply ultrasound energy through the abdomen of a high-risk pregnant woman. (High-risk pregnancy conditions include the following: multiple pregnancy, maternal hypertension, hydrops, diabetes, lupus, and placental abnormality.) Pulsed Doppler allows the qualitative and quantitative measurement of the velocity of blood flow in fetal and maternal vessels. Color Doppler allows the qualitative measurement of the velocity of blood flow in fetal and maternal vessels. These methods are adjunctive, not screening tools, for the detection of structural anomalies of the fetal heart. They are also adjunctive for the diagnosis of intrauterine growth retardation.

Scanhead Selection

The C5–2, C8–4v, C7–4, P3–2, P5–3, and the P7–4 scanheads are qualified for fetal Doppler use. These scanheads can provide real-time 2D, Color Doppler, and pulsed Doppler ultrasound information.

Scanhead Performance and Accuracy

The FDA recommends that each clinic conduct a clinical trial to establish the intra-operator and inter-operator variances that exist with each scanhead used with the ultrasound system. The FDA recommends the following protocol be followed in establishing these variances:

1. Select at least 20 high-risk patients.
2. For each patient, select at least one Doppler waveform from the same fetal artery.

3. For each Doppler waveform, have each of at least three trained sonographers independently complete at least three repeat measurements for each of the Doppler calculations (for example: Systole/Diastole Ratio, Pulsatility Index, and Resistive Index).
4. Perform an appropriate analysis of variance over all 20 patient waveforms and also for each patient waveform separately.
5. Use the results of the analysis of variance to estimate both intra-operator and inter-operator variance components.

Exam Considerations

All vessels have characteristic Doppler spectral displays, though some are difficult to visualize and interrogate with Doppler because of their size, location, or tortuosity. For these reasons, it is sometimes difficult to reproduce a specific display. Research studies have shown that the umbilical vessel may be more easily interrogated than the uterine, placental, or fetal vessels. Factors to consider during an exam are as follows: the specific vessels of interest, sample volume location in the vessels under interrogation, number of sample measurements for evaluation, sample volume size, and the vessel being investigated.

Current evidence does not indicate that Doppler waveform analysis in these obstetrical conditions provides information that is meant to replace other conventional tests or the biophysical profile. Also, Doppler studies and color flow analysis should not replace classical non-Doppler ultrasound scanning methods. Rather, it appears that Doppler waveform analysis is of value when used with these other tests. As with the evolution of any new diagnostic technique, the indications for use may change when new experimental data becomes available.!

ATL recommends the following general guidelines at this time: color flow provides a qualitative technique, ideal for locating a vessel, detecting the direction of flow, and identifying the best placement of sample volume. Spectral waveform analysis is a quantitative technique that is useful in the quantification of frequency or velocity of flow within a structure.

Intrauterine Growth Retardation

Many studies have shown a good correlation between abnormal waveform, decreased blood flow, and increased perinatal mortality@, fetal hypoxia#,$,% and neonatal events such as necrotizing enterocolitis (NEC), and interventricular hemorrhage (IVH).% Doppler studies initially designed to identify altered fetal growth had a predictable low sensitivity^ because the category of “small” for dates frequently includes genetically small but completely normal fetuses and neonates. All studies have shown that the rare Doppler pattern of reverse diastolic flow in the umbilical artery has been very highly correlated with adverse outcome&,* and may warrant immediate intervention. Conversely, a normal waveform in the umbilical artery has been rarely associated with still-birth in a high-risk pregnancy.(

Fetal Cardiac Anomalies

Doppler has become an integral part of fetal echocardiographic studies. Its use has been directly derived from well-documented pediatric and adult Doppler research. The etiology and seriousness of fetal arrhythmias is relatively easy to determine with pulsed wave Doppler interrogation of ventricular diastolic filling patterns!),!!,!@,!#. Benign patterns such as premature, atrial, and extra systoles can be more easily diagnosed with Doppler than with the older approach of M-mode echocardiography. Doppler has proven useful as well in the understanding and interpretation of structural heart disease in the fetus. A close correlation has been found between atrioventricular valve regurgitation in the fetus with structural heart disease and the appearance of non-immune hydrops.!$ Improved diagnostic and prognostic ability has permitted more accurate counseling of parents whose fetuses have structural cardiac abnormalities.!%

Uterine Vessel Flow

The uterine artery signals can be more difficult to obtain and can require more training to develop expertise. Direct the scanhead to the lower quadrants at the paracervical area where the uterine artery enters the uterus. Three potential signals may be encountered. The examiner should be persistent until the correct waveform is identified. The mature waveform is generally present by 20 weeks, but should be achieved no later than 26 weeks. The pulse wave frequency should coincide with the maternal pulse. Four equal and uniformly dense images should be seen on each side of the uterus. The results from both sides are averaged to give a single number. The systole/diastole (S/D) ratio appears to provide a simple and reproducible measurement, but a number of other calculations have also been proposed. Inter-operator error with this technique is 4% with a maximum error of 10%.!&

Clinical Instructions for Use

Using 2D real-time imaging, locate the structure designated for Doppler evaluation. Color Doppler can be used to help identify the structure of interest and determine the best Doppler angle. Once the structures have been identified with 2D and Color Doppler, pulsed wave Doppler can be used to obtain the correct Doppler waveforms.

With pulsed wave Doppler obtain three to four clear, dense waveforms of equal amplitude. If there is fetal breathing, the Doppler waveforms will not be equal in intensity or frequency. Measurements must be postponed until the fetus is quiet. If there is tachycardia or bradycardia, the measurements have no clear meaning because the waveform represents a complex mixture of resistance and cardiac output. Time will be needed to empty the vascular region. The image can then be frozen and the measurements taken. It is useful to record the examination on tape because the signal is immediately captured and is retained even when the fetus or cord moves.

Imaging and measurements should be repeated twice more, and the results from the three studies averaged. Although the S/D ratio is, in theory, an angle-independent measurement, there can be differences in the ratio when the artery is studied near the abdomen or near the insertion in the placenta. When three different angle measurements are taken, an average experimental error of 6% and a maximum error of 16% are found.

Umbilical Artery: Duplex Pulsed Wave Doppler!*

1. Obtain an image that displays as much of the umbilical artery as possible.
2. Place the sample volume over one of the two smaller vessels of the umbilical cord.
3. Increase the sample volume size until it encompasses the entire vessel.

If this vessel is viewed only in cross-section, and diastolic flow is not shown, then an artifact caused by the angle between the beam and the vessel exists. Another sampling site should be examined, or an angle of about 60 degrees should be used. When the cross-sectional view is obtained, rotating the transducer 90 degrees can bring a greater length of the umbilical cord into view. The long axis view of the umbilical cord helps the examiner select the most advantageous angle.

4. Indices of pulsatility, if calculated, should be determined for each of several heart beats. These heart beats should then be averaged.

Uterine Artery: Duplex Pulsed Wave Doppler!(

1. Place the scanhead in the lower outer portion of the maternal abdomen. The orientation of the scanhead should be towards the parametria with some parts of the amniotic sac seen.
2. Move the sample volume until the characteristic waveforms of the parametria are seen.
3. Examination should be confined to the area that is composed of the myometrium and can be most fruitful close to the placenta.
4. Indices of pulsatility, if calculated, should be determined for each of several heart beats. These heart beats should then be averaged.

Fetal Heart: Duplex Pulsed Wave Doppler@)

1. Examine the fetal heart in all standard planes to determine whether the anatomy is normal. Verify the following planes: four-chamber view, long axis left ventricle, short axis of the ventricles, short axis of the great vessels, aortic arch, and pulmonary artery-ductus views.

Excluding the actual valves from the sample volume will help to minimize unnecessary noise from the signals obtained.

2. The area for sampling should be seen as clearly as possible with the anticipated flow direction at as low an angle as possible to the ultrasound beam (as close to parallel to flow as possible).

Color flow Doppler will help determine optimal sample volume placement.

3. Select the sample volume location and sample volume size.
4. Output should be at the lowest setting compatible with obtaining an adequate image and Doppler display.
5. The Doppler gain setting should be maintained to keep an adequate signal without excessive noise.

Fetal Doppler References

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17. Ibid.

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Menstrual Age (MA) in Weeks and Days by Last Menstrual Period Date

$$MA_{weeks} = Current\ date - LMP\ date$$

Biophysical Profile

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Early Gestation

Gestational Sac (GS)

Equation

Gestational sac measurements provide an estimate of gestational age from about 5 weeks to 13 weeks. When using Nyberg's Gestational Sac equation to estimate gestational age, ensure that three distance measurements are entered into the patient report (height, width, and length) for accurate age estimation. The Early Gestation protocol will give you a gestational age based on the mean of one, two, or three distance measurements; however, Nyberg's gestational age equation requires all three distance measurements for an accurate estimate.

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Crown-Rump Length (CRL)

Equations

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Fetal Age

Abdominal Circumference (AC)

Equation

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Table

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Biparietal Diameter (BPD)

Equation

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Cerebellum (CEREB) Equation

Hill, Lyndon, M., et al. “The Transverse Cerebellar Diameter in Estimating Gestational Age in the Large for Gestational Age Fetus.” *Obstetrics and Gynecology*, Vol. 75, No. 6, 981–985, June 1990.

Clavicle Length Table

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Femur Length (FL)

Equations

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Table

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Head Circumference

Equation

Hadlock, F., Deter, R.L., Harrist, R.B., Park, S.K. “Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters.” *Radiology*, 1984, 152: 497–501. (Biometric Age and Growth Equations)

Table

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Humerus Length (HUM) Table

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Occipito-Frontal Diameter (OFD) Table

Hansmann, Hackeloer, Staudach, Wittman. “Ultrasound Diagnosis in Obstetrics and Gynecology.” *Springer-Verlag, New York,* p.431, 1986.

Outer Orbital Diameter (OOD) Table

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Tibia Length (TL) Table

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Transverse Trunk Diameter (TTD) Table

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Ulna Length Table

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Fetal Growth

Biparietal Diameter (BPD)

Equation

Hadlock, F., Deter, R.L., Harrist, R.B., Park, S.K. “Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters.” *Radiology*, 1984, 152: 497–501. (Biometric Age and Growth Equations)

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Femur Length (FL)

Equation

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Humerus (HUM) Tables

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Tibia Tables

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Abdominal Circumference (AC)

Equation

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Table

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Head Circumference(HC)

Equation

Hadlock, F., Deter, R.L., Harrist, R.B., Park, S.K. “Estimating Fetal Age: Computer-Assisted Analysis of Multiple Fetal Growth Parameters.” *Radiology*, 1984, 152: 497–501. (Biometric Age and Growth Equations)

Table

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Head Circumference/Abdominal Circumference (HC/AC) Table

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Estimated Fetal Weight (EFW)

Equation

Hadlock, F., Harrist, R.B., Martinez-Poyer, J. “In-utero Analysis of Fetal Growth: A Sonographic Weight Standard.” *Radiology*, 1991, 181: 129–133.

Table

Hansmann, Hackeloer, Staudach, Wittman. “Ultrasound Diagnosis in Obstetrics and Gynecology.” *Springer-Verlag, New York,* 1986, p 186.

Fetal Ratios

Biparietal Diameter to Occipito-Frontal Diameter Ratio %

Hadlock, F., Deter, R., Carpenter, R., Park, D. “Estimating Fetal Age: Effect of Head Shape on BPD.” *American Journal of Roentgenology*, 137: 83–85, July, 1981. (Cephalic Index)

Femur Length to Abdominal Circumference Ratio %

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Head Circumference to Abdominal Circumference Ratio

Campbell, S. “Ultrasound Measurement of the Fetal Head to Abdomen Circumference Ratio in the Assessment of Growth Retardation.” *Br J Obstetrics and Gynaecology*, Vol. 84, 165–174, March 1977.

Fetal M-Mode Protocol

LV Fractional Shortening, percent

Oh, J.K., Seward, J.B., Tajik, A.J. *The Echo Manual*. Boston: Little, Brown and Company, 1994, p. 43.

LV Ejection Fraction, percent

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Glossary

For definitions of ultrasound terms, refer to the American Institute of Ultrasound in Medicine, *Recommended Ultrasound Terminology*, Second Edition, 1997.

: The film format icons that appear in the upper right of the screen. Each icon represents a sheet of film and how it is being allocated for printing. The subdivisions are referred to as cells. A cell is a spatial location on the print medium or film allocated for an image. The order in which the cells are filled starts in the upper left corner and moves across to the right, from top to bottom of the available space. The icon on the left is for color images; the icon on the right is for black-and-white images. These icons will only appear when the Print Environment, Image Management system setup, is set to Print All, a network printer is selected, or with DiskLink-only systems. Ending an exam clears the cells of the film format icons. These icons are not printed or stored with the image.

: An icon that flashes in the upper left of the screen to indicate a transfer of data from the hard disk to an optical disk, archive device, or printer. When you copy to the optical disk or end an exam, and exam images are being stored on the optical disk, this icon appears on the screen and blinks. This icon is not printed or stored with the image.

: An icon that appears in the lower right corner of each image of the Review Images screen. It is referred to in the text as the review format box. When you use the trackball to move the arrow cursor to the review format box, and press the SELECT control, the review format changes between the 4-on-1 and 1-on-1 image review formats, depending upon the existing review format. Before you can edit or measure a review image, the image must be in the 1-on-1 format. The review format can also be changed in Image Management setups.

: Identifies a stored loop in the exam directory.

*** (asterisk)**: On a review image indicates that the image has been tagged for printing. See also “Print Environment.“

: Select to view a captured stream or clip of video from the hard disk. Allows playback of a full video clip.

% (Percent) Area Reduction: An optional measurement tool that calculates the percentage of area reduction in a vessel.

% (Percent) Diameter Reduction: An optional measurement tool that calculates the percentage of diameter reduction in a vessel.

↑ **(arrow cursor)** : A pointer moved with the trackball.

0/60°: A control used to select a Doppler angle correction value. See also “ANG COR.”

1st Half Systole: An auto-trim selection used to display the first half of the systolic frames present in a clip.

150dB/Cn: On the 2D/MMode menu, 150dB is the full dynamic range the system uses/Cn is the compression curve selection, n is a number from 1 through 5. See also "Dynamic Range."

1 Distance: A volume calculation method that uses one distance measurement to estimate the volume of an object.

3 Distances: A volume calculation method that uses three distance measurements to estimate the volume of an object.

2D/MM: Two-Dimensional/M-Mode. A control that displays the 2D/MMode menu.

2D/MMODE: A group of controls used to adjust focal zone, focus, depth, compression, sector width, zoom, Compound imaging, M cursor, and High Definition Zoom.

2D Area Method: A measurements setup. Selects trace by points, continuous trace, or ellipse.

2D Chroma: A superkey that changes the 2D Chroma map.

2D CINE: A softkey used to play back the 2D Cineloop review.

2D GAIN: A control that adjusts the overall gain applied to the 2D echoes.

2D Maps: A superkey that changes the 2D gray map setting.

2D Pers: A superkey that changes the 2D persistence setting.

2D PRF: A selection on the 2D/MMode menu used to set the 2D PRF.

3D/CINE: Three–Dimensional/Cineloop Review. A control that displays the 3D/CINE menu.

3D CALIB: A softkey used to start and stop 3D calibrated acquisition.

3D OPT: A control used to optimize the system for 3D imaging.

3D UNCAL: A softkey used to start and stop uncalibrated Cineloop acquisition.

A Wave Amplitude: A distance measurement in the M-Mode Pulmonic Valve protocol. The A wave is the downward motion of the pulmonic valve and follows atrial contraction; it coincides with the A wave of the mitral valve.

Abdominal Circumference (AC): An OB measurement used in the fetal biometry to obtain an estimate of ultrasound age.

Acceleration Time (AT): The period of time over which the rate of change increases in value. See also: "Deceleration Time."

ACCEPT: A softkey used to store a clip on the DVS hard disk.

Accept Prior to Store: An Acquisition Parameters setup used to automatically store clips on the DVS hard disk or to require review and acceptance of a clip before storage.

Accession Number (#): An optional 16-character field that may be assigned to each patient file by the institution for its internal information management purposes.

Acquisition Parameters: In Setups, a category that includes user options for configuring frames, clips, and acquisition protocols for stress echocardiography exams.

Acquisition Protocol: A type of image capture using the Digital Video Streaming (DVS) option. Examples of acquisition protocols are Two Stage Full Disclosure, Three Stage Bicycle, and Pharmacologic. See also "Measurement Protocol."

Adult MMode Vol Calc Method: A display setup. Select between the Teicholz or cubed methods of calculating volume in the R/L Ventricle M-Mode measurement protocol.

ADV MEAS: A system control that displays the Meas Tools menu.

Advance to Next View: An Acquisition Parameters setup used to determine if the system automatically advances to the next logical view in an acquisition protocol.

After Each Image: A setting for the Store Images During Exam setup. Selecting it spools images to an archive device after the images are stored to the hard disk. See also "At End of Exam."

Alias: A descriptive name for a device. It is used in the creation of the host table. The alias name for the ultrasound system and the archive devices appear in the System Configuration setups as the Ultrasound System Net ID. See also "Ultrasound System Net ID."

All Cycles: A play selection on the toolbar used to display the first cycle of a clip. ECG must be present. See also "As Acquired."

All Frames: An auto-trim selection used to display all of the frames in a clip.

Amniotic Fluid Index (AFI): An OB measurement protocol that provides a means to assess fetal status from the measurement of amniotic fluid in the maternal abdomen.

Amniotic Fluid Volume: A factor of evaluation in the OB biophysical profile.

Angle Correction (ANG COR): ANG CORR is a COLOR/DOPPLER control. During Doppler acquisition, the blood flow may not be directly toward or away from the transducer, so there is an angle between the ultrasound beam and the blood flow. To ensure accurate display of blood flow velocity, the angle between the ultrasound beam and blood flow is included in the calculation that is used to derive the Doppler display scale for velocity.

Annotation: A category of system setups that allows you to customize the Text A, B, C, and D keys. For a Tissue Specific or custom preset, you can create a list of specific terms that you might want to use during an exam. These terms are assigned to one of the four Text keys. Once created in Setups, these terms are available during an exam by pressing the Text key to which you assigned them.

Anterior Posterior Diameter (APD): An OB measurement of the thorax used in the fetal biometry to obtain an estimate of ultrasound age.

Aorta/Left Atrium (Ao/LA): Aorta and left atrium ratio. AAO/LA cardiology measurement protocol from which aortic valve function can be evaluated.

Aortic Valve Area (AoV Area): A cardiology measurement protocol from which the aortic valve area can be calculated.

Append Study: A selection on the Patient List used to add images or data to a study or series.

Apply: A selection on the Configuration Files screen. It verifies the configuration files and identifies errors in the host table or devices files.

Archive Device: A destination to which patient exam data is sent. Examples of archive devices are the hard disk, a network server, and the optical disk. Archive Device is also a setup on the Image Management Network screen used to select the network archive destination to which images are sent.

AREA: A system control used to initiate a trace of the perimeter of a displayed object.

As Acquired: A play selection on the toolbar used to display images as they are acquired, regardless of the presence of triggered frames. See also “All Cycles.”

At End of Exam: A setting for the Store Images During Exam setup. Selecting it spools images to the archive device when you press the END EXAM control. See also “After Each Image.“

Atrial Reversal Duration (ARD): A measurement on the Pulmonic Veins Doppler measurement protocol. The time interval between the beginning of atrial reversal and the end of atrial reversal.

Atrial Reversal Velocity (ARV): Atrial reversal velocity is peak velocity measured distal to the orifice of the pulmonary valve.

Auto Freeze: A display setup. Selects between turning the auto freeze capability on or off. Turning auto freeze on, automatically invokes a freeze command, if a control is not manipulated within a specified period of time (30 minutes). After auto freeze has been invoked, press any control to restart imaging.

Auto-Send Pending Exams on Reconnect: An Image Management general option. It sets up the system so pending exams are sent automatically to a printer or archive device when the network is reconnected. This setup is valid when the system detects a portable condition. See also, "Portable Exam," "Pending Exams."

Average Ultrasound Age (AUA): Ultrasound age derived from the average of a number of OB ultrasound measurements performed during the patient exam.

B&W # Pg #: The Image Management Printer image information for B&W (black-and-white) film format. It appears on the left side of the screen. B&W is followed by the number of B&W images stored for the patient. Pg is followed by the number of pages of film required for the B&W images. See also "B&W Film Format."

B&W Film Format: An Image Management Printer setup: 1x1, 1x2, and 3x5 are examples of film format. The settings displayed depend upon the desired B&W network printer setup. This setup is available with the Image Management Network option, and DiskLink-only systems. For DiskLink-only systems, the film format must agree with the printer configuration.

B&W Printer: An Image Management Printer setup that selects and configures the B&W network printer to which the images will be printed. This setup is available with the Image Management Network option.

B&W Printer Setups: Network Administration setups in the Directory of Image Management Setup Options. These setups include printer type, film size, film format, film orientation, film type, destination, and printer density.

Background: A Power imaging feature that allows you to change the background in the Power imaging display.

Background Color: A monitor module control allows you to choose the background color of the monitor.

Backspace: The key on the system keyboard that moves the cursor back a space.

Backup: A selection on the Configuration Files screen. It creates a backup copy of the configuration files on the hard disk.

Baseline: Represents zero velocity or frequency in the Doppler or color Doppler display. The zero line or baseline on the Doppler display or color map can be shifted up or down using the BASELINE control.

Beats Per Image: A capture length setting in the Acquisition Parameters setups for clips that sets the number of heart beats per image acquisition.

Best Beat: An Acquisition Parameters setup used to determine when best beat selection occurs: at the end of the protocol, at each stage, or at each view.

Biopsy: A superkey that turns the biopsy guide display on or off.

Biopsy Guide Line: Display guide line within the 2D sector or linear image representing the path along which a biopsy needle should pass.

Biplane: Refers to the longitudinal and transverse planes of the heart.

Biparietal Diameter (BPD): Biparietal diameter is an OB measurement used to calculate ultrasound age.

Blend: A Power Imaging Background setting.

Blue: A type of film. See also "Clear and Paper."

Body Marker: A key used to position display icons on the image. The body marker is used with the scanhead position marker.

Body Surface Area (BSA): A calculation from the height and weight of the patient. It appears in the patient data entry form in the additional patient data. BSA is used to calculate other indices, for example, cardiac index.

Brightness: A monitor module control that adjusts the light output of the display.

CALCS: A control used to display menus from which measurement protocols can be selected. Measurements are performed and entered into the protocols and the patient report.

Calibration: Before a stored or freeze-frame image can be measured, the system must be calibrated to the freeze-frame image scaling.

Camera Footswitch: A peripherals setup. Selects the footswitch control for either VCR or printer.

CANCEL: A softkey used with the DVS option to stop acquisition of a clip and delete the images captured during the current acquisition. In 3D imaging, aborts the current 3D acquisition and returns to 2D imaging.

Capacity: The hard disk capacity depends upon size and image type.

CAPTURE: A softkey used to initiate acquisition of a clip with the DVS option or a Cineloop sequence with the Image Management option.

Capture Format: An Acquisition Parameter setup used to set the display format for captured clips.

Capture Length: An Acquisition Parameter setup used to set the amount of time, or the number of beats per image/the number of images per view.

Capture Mode: An Acquisition Parameter setup used to determine the behavior of the CAPTURE softkey. See also "Prospective," "Retrospective," and "Full Disclosure."

Cardiac Output (CO): The system includes a cardiology measurement protocol from which you can obtain a calculation of cardiac output. The CO measurement tool also calculates cardiac output from diameter, VTI, and heart rate measurements.

Caution: Information in the manual set that describes precautions necessary to protect the equipment.

Cavitation: A mechanical bioeffect that refers to the reaction to ultrasound energy of bubbles or pockets of gas or vapor in tissue or fluid.

CDisp: A superkey that turns the color in the Color display on or off.

CMaps1: A superkey that cycles through the available color maps.

Cell: A spatial location on the print medium allocated for an image.

Cephalic Index (CI): An OB ratio: biparietal diameter/occipito frontal diameter expressed as a percentage.

CH A/Pulse Transducer: A physio setup. Selects the type of pulse transducer connected to the channel A receptacle.

CH B/Phono Transducer: A physio setup. Selects the type of phono transducer connected to the channel B receptacle.

Chroma Maps: A display that assigns color values to the gray map to accentuate certain echo intensities or ranges of intensities.

Cineloop Review: A process for digitally acquiring and reviewing a series of sequential images.

Cine Playback: A key that performs the same function as the Play/Pause selection on the Cineloop Review menu–toggles between play and pause in Cineloop Review.

Circuit Breaker: Located on the back of the system, the circuit breaker is used to switch power on or off.

Clear: A type of film. See also “Blue” and “Paper.“

CMaps1: A superkey used to change the Color map.

Col # Pg #: The Image Management Printer image information for color film format. It appears on the left side of the screen. Col is followed by the number of color images that have been stored for the patient. Pg is followed by the number of pages or sheets of film required for the color images. See also “Color Film Format.”

COL GAIN: A control that adjusts the gain of the Color and Power image. Also adjusts the saturation of the VCR playback display.

Collection: An arrangement of several images for comparison and review.

Color: A Color Flow image, Color Power Angio image, Power Motion image, Chroma image, or Color M-mode image. COLOR is a control that turns Color Flow imaging on and off.

Color Bar: A rectangular bar that is the color equivalent of the gray bar. It is a visual representation of blood flow velocity, variance, or power versus color.

Color Film Format: An Image Management Printer setup: 1x1, 1x2, and 3x5 are examples of film format. The settings displayed depend upon the desired Color Printer setup. This setup is available with the Image Management Network option.

Color Flow Imaging: A mode of imaging in which Doppler information is detected over a portion of the 2D image. The Doppler shift is then displayed in real-time as color against a standard gray scale representation of anatomical structures.

COLOR MENU: A control that displays the Color menu.

Color Power Angio (CPA) Imaging: A 2D or 3D Color display based on the power or energy within a sample blood flow.

Color Printer: An Image Management Printer setup. It allows you to select and configure the color network printer to which the images will be printed. This setup is available with the Image Management NetLink option.

Color Printer Setups: Network Administration setups in the Directory of Image Management Setup Options. These setups include printer type, film size, film format, film orientation, film type, destination, and printer density.

Color Overlay: A graphic representation on the 2D image in which Color or Power data is displayed.

COMPRESS: A control used to select a compression curve. See also "Dynamic Range."

Compress at: An Acquisition Parameters setup used to determine when compression will be applied, stage or view.

Compression: An Acquisition Parameters setup used to set the compression level of frames and clips. Large areas of dark content may be compressed at a rate higher than 30:1. See also "Lossy Compression."

COMP-VID Input Port: A peripherals setup used to select the external VCR connected to the COMP-VID input port on the rear of the system.

Configuration Files: Network Administration setups in the Directory of Image Management Setup Options. These setups allow you to modify or transfer network configuration files.

Configure Clips: A group of Acquisition Parameter setups used to set the capture format, capture length, compression level, storage sequence, and ECG triggering of a clip.

Configure Frame: A group of Acquisition Parameter setups used to set the compression level of a frame.

Configure Protocol: A group of Acquisition Parameter setups used to create new acquisition protocols and to copy and modify existing protocols.

Connectivity: The networking or connecting of ultrasound systems, printers, file servers, workstations, and other devices for the purpose of printing, storing, and recalling patient exams.

Continuous Trace: A 2D and Doppler trace type used to trace an object to determine the area and circumference or the VTI. See also "AREA."

Continuous-Wave Doppler (CW): A Doppler ultrasound mode that uses continuously transmitted and received ultrasound energy.

Contrast: A control on the monitor module that adjusts the difference in light output between the light and dark parts of the display.

Control Panel: The primary user interface module that includes the imaging controls, keyboard, and trackball.

Copy: (1) The process by which the range of user Tissue Specific setups is transferred to an optical disk (2) A selection on the Configuration Files screen. It copies files from the hard disk to an optical disk.

Copy To: (1) On the Exam Directory screen, is used to copy selected exams to a destination. (2) With the DVS option, a selection in the patient directory used to copy selections in the patient directory to the optical disk or from the optical to the hard disk.

Copy Protocol: A selection on the Configure Protocol screen used to copy a selected acquisition protocol to create a new protocol.

Counter: A superkey that displays the VCR frame counter dialog box.

CPers: A superkey that changes the Color or Power persistence setting.

Create 3D: An item on the 3D/CINE menu used to create the 3D image from the acquired 2D images in the Cineloop buffer.

Crown Rump Length (CRL): An early gestation measurement that provides an estimate of menstrual age from about 6 weeks to 21 weeks.

Current Patient: The patient name currently displayed in the patient data entry form.

Cursor: Any one of several user-controlled graphic objects used to pinpoint the location of an object on the screen.

CURSOR: A control used to display an M-line or D-line on the 2D image, before starting M-mode or Doppler imaging.

Curved Array: Scanhead with parallel elements in a curved layout.

CVID: Composite video. The system has a connector on the back for composite video devices.

CW: Continuous wave. A control used to turn on and off the CW Doppler display.

CW Focus Indicator: Graphic drawn on the CW D–line to indicate the CW Doppler transmit focal point.

d:D Ratio: An optional measurement tool used to calculate a ratio of femoral head coverage for infants.

D-line: In Doppler imaging, a line on the 2D display representing the 2D line from which the Doppler display is acquired.

Data Exchange File Format (DEFF): Data Exchange File Format or DEFF is a standard for disk-based transfer of information.

Data Transfer: A way to transfer patient report data for computer archive, off-line analysis, and other research activities.

Date: A system setup used to set the system date.

Deceleration Time (DT): In Doppler, the period of time over which the rate of change decreases in value. See also "Acceleration Time."

DEL IMG: A control used to delete the last image stored on the system hard disk. With the DVS option, it deletes the selected images in review.

DEL MEAS: A control used to erase the current measurement or a portion of the circumference measurement.

Delete: (1) On the Review Images screen and the Exam Directory screen, deletes images from the current patient exam or an entire exam from the exam directory. (2) With the DVS option, a selection on the patient directory used to delete the selected item.

Delete Protocol: A selection on the Configure Protocol screen used to delete a selected acquisition protocol.

Delete Stage: A selection on the Configure Protocol screen used to delete a selected stage.

Delete View: A selection on the Configure Protocol screen used to delete a selected view.

DEPTH: A rotary control. The depth of ultrasonic echoes displayed in the sector image is based on the assumed constant velocity of ultrasound in tissue, 1540 meters/second.

Destination: 1) A device on which images are stored. 2) A B&W and Color Printers setup with settings based on the selected film type. See also "Magazine" and "Processor."

Devices: Printers, file servers, ultrasound systems, and archive devices.

Device Table: Lists all the printers, file servers, ultrasound systems, and archive devices approved by ATL for use with NetLink.

Diagnostics: In Setups, a category that includes system error collecting and reporting, running and recording results of self tests.

Dialog box: A display element that requires user interaction or response.

DICOM Conformance Specification: A document written by each vendor to describe their device and its conformance to the DICOM standard.

Digital Imaging and Communication in Medicine (DICOM): DICOM is a standard for network communication.

DICOM Modality Performed Procedure Step (MPPS) Feature: For scheduled patient exams from a worklist, the MPPS feature allows you to discontinue a patient exam. The MPPS feature provides for the transfer of information about the exam to a DICOM MPPS server. After an exam is completed, the MPPS feature sends information to the MPPS server indicating whether the exam was completed.

DICOM Storage Commit Feature: For scheduled patient exams from a worklist, the DICOM SC feature allows you to send images to a network server for archival.

Digital Echo: An acquisition protocol that includes a routine stage comprising several views with different imaging modes. This acquisition protocol is not intended for stress echo exams.

Directory: Listing of patients, setups, or other things. The system uses two main directories: the Directory of Setup Options and either the DVS or the Image Management directories.

Discontinue: A selection on some Patient Data Entry forms used to discontinue an exam. The Clinical Information System (CIS) or the billing server can then handle this type of procedure differently than a patient exam that is completed normally. See also "DICOM Modality Performed Procedure Step (MPPS) Feature."

Disp Format: A superkey used to change the scrolling display size.

Display: A category of setups in the Directory of Setup Options.

Display Warning When: An Image Management system setup that specifies when the system will display a warning message that the storage space on the optical disk or the hard disk is getting low.

DISTANCE: A control that starts a linear distance measurement.

Dist/Ellipse: A volume measurement method that calculates volume from a distance and an ellipse measurement.

DONE: A softkey used to end the acquisition of a clip.

Dop Chroma: A superkey used to change the Doppler Chroma map.

DOP GAIN: A rotary control used to adjust the Doppler gain.

Dop Maps: A superkey used to change the Doppler gray map.

Doppler Area Method: A measurements setup used to select trace by points or continuous trace.

DOPPLER MENU: A control used to display a menu of Doppler parameters.

Doppler Results Display: A measurements setup. Provides a menu from which you may select the Doppler results that you want to display.

Dotted Line: A display setup used to turn on or off the dotted line between the measurement cursors.

dP/dT: Represents the isovolumic phase index of left ventricular contractility; dP/dT is the rate of left ventricle pressure rise.

Dual: A capture format setting in the Acquisition Parameters setups for clips that sets the display format for two images per screen for captured images and determines the size of the region of interest (ROI) box.

DUAL: A control used to display two 2D images side by side.

Dyn Rg: A selection on the CPA or PMI menu used to change the dynamic range setting. See also "COMPRESS."

Dynamic Motion Differentiation (DMD): Filter that eliminates the clutter component from the Color Flow display.

Dynamic Range: The range of signal amplitudes extending from the largest unsaturated signal to the smallest signal just discernible above system noise. Dynamic range is usually expressed in decibels (dB). See also "COMPRESS."

E/A Ratio: E denotes the first peak velocity in the Doppler waveform. A denotes the second peak velocity in the Doppler waveform.

Early Gestation: An OB measurement protocol.

ECG Trigger: (1) Electrocardiogram (ECG) trigger. Allows you to set one or two points relative to the R-wave of the ECG in which some event takes place. An example is the automatic updating of the 2D image during ECG trigger operation. (2) An Acquisition Parameters setup used to turn the ECG trigger on or off: when this setup is turned on, acquisition occurs on the next available R-wave; when it is off, all frames are captured with no ECG gating.

Edit: A selection on the Configuration Files screen. It displays the screen from which you can select the Host Table, Device Table, or Devices.

Eject Disk: A selection on the Net/Disk menu used to eject the optical disk.

Ejection Fraction (EF): A cardiology calculation that appears on some measurement protocols and in the patient report. It represents the percent or fraction of left ventricular diastolic volume that is ejected in systole.

Electrocardiography (ECG): The electrical activity that controls the heart muscle can be detected and displayed on the electrocardiograph. The ECG waveform can be used as a reference for cardiac timing.

Ellipse: A 2D trace type that is used to measure objects. Circumference and area calculations are derived from the measurement.

END EXAM: A control that closes the current patient file, after which all deletions and image changes performed during the exam are incorporated into the file on the network device, hard disk, or the optical disk. See also "Store Images During Exam."

Erase Arrow: A key used to erase arrows on the screen.

Erase Line: A key used to erase a single line of text. The cursor must be located on the line.

Erase Screen: A key that erases all annotation on the screen.

Erase Text: A key that erases all text from the screen.

Established Due Date: User-entered date, believed to be valid based on any other available information (previous ultrasound exams or other test results).

Estimated Date of Delivery (EDD): Calculation derived from either the last menstrual period (LMP) or the average ultrasound age (AUA).

Estimated Fetal Weight (EFW): Estimated fetal weight is calculated from one or more OB measurements.

Ethernet: A local area network technology.

Exam Dir: A selection on the Review Images screen, displays the Exam Directory screen.

Exam Directory: A list of all the patient exams on the source disk.

FF (Fast Forward): A softkey used to quickly advance the videotape.

Femur Length (FL): A fetal biometric measurement used to estimate ultrasound age.

Fetal Biometry: The statistical study of fetal biological data. Within the context of the system, a display format that allows you to enter fetal measurement values from which the system calculates ultrasound and average ultrasound age or estimated fetal weight.

Field A/B: A superkey. A video frame consists of two video fields, commonly referred to as field A and field B. It can be useful, when looking at VCR images, to look at only one field at a time.

File Selector: Displayed when you select Devices from the Edit Configuration Files screen. The file selector displays the directory and the related list of device files from which you can select and display individual device files.

File Server: A computer that provides access to resources that are shared on a network.

Film Format: A setup on the B&W Printers and Color Printers screens that has various settings, based on the selected printer and film size.

Film Size: A setup on the B&W Printers and Color Printers screens that has various settings, based on the selected printer.

Film Type: A setup on the B&W Printers and Color Printers screens that has various settings, based on the selected printer.

FILTER: A control used for selection and control of frequency bandwidths. A control used to establish the wall filter used during Doppler acquisition.

Flow Direction Cursor: The small line drawn over the sample volume graphic to indicate the angle correction applied to the Doppler data.

Focal Length: The length over which the beam width is less than or equal to twice the beam width at the focal point.

Focal Point:The point where the focal plane and the beam axis intersect.

Focal Zone: That portion of a focused ultrasound beam extending axially on either side of the focal point in which the amplitude of an echo from a standard echo source is not reduced more than 6 dB.

FOCUS: A control used to control the depth of the focal zones.

Format: Refers to the relative size of the scrolling display.

Format Disk: A selection on the Net/Disk menu used to format the optical disk.

Frame Counter: A peripherals setup used to turn the VCR frame counter on or off.

Frame Rate: Number of acquisition image updates per second.

FREEZE: A control used to stop and start system image update.

Freeze Frame: Feature in which the VCR playback image is frozen and stored in system image memory.

Frequency: Display in Doppler imaging in which the Y–axis is Hertz (cycles per second), and the X–axis is time.

Frequency Conversion Technology (FCT): See "Tissue Harmonic Imaging."

Full Disclosure: A setting in the Acquisition Parameters setups for capture mode. Image capture occurs continuously after the CAPTURE softkey is pressed for a capture length of 256 beats.

Full Screen: A capture format setting in the Acquisition Parameters setups for clips that sets the display format for captured images.

Gateway Address: An address maintained by the system administrator used to provide access to wide-area networks over links from a local-area network environment.

General Options: A group of Image Management setups available from the Directory of Image Management Setup Options.

Gestational Age: Age calculated from LMP or date of conception, depending upon the original investigator's technique.

GMap n: A selection on the 2D/MMode menu, where n is a number that corresponds to a gray map selection.

Gray Bar: A visual representation of the gray scale. See also "Gray Scale" and "Gray Maps."

Gray Map: A video depiction of the gray scale that is displayed on the system monitor. See also "Gray Scale" and "Gray Bar."

Gray Scale: The scale used to assign shades of gray to different signal amplitudes. The brightness of the dot representing a particular signal is proportional to the signal amplitude. The gray scale varies from black to white through a specified range of gray shades. See also "Gray Maps" and "Gray Bar."

Half Time: Pressure half time is the time interval required for maximal pressure gradient to reach its half level. It is also the same as the interval for the peak velocity to decline to the peak velocity divided by the square root of 2. It is always proportionally related to deceleration time.

Hard Disk: An electronic storage device used to store ultrasound images.

HD ZOOM: A control used to choose a region on the display from which to generate a High Definition image.

Head Circumference (HC): A fetal biometric measurement used to calculate ultrasound age.

Heart Rate: Measurement tool used to calculate the heart rate in beats per minute (bpm).

Hertz (Hz): A unit of frequency equal to one cycle per second.

High Level ECG: The system can display high level ECG from other sources (stress echo or cardiac care unit). The high level ECG receptacle is located on the front of the system.

High PRF Doppler: A Doppler imaging technique. A pulse is transmitted before the echo from the previous pulse has been received by the transducer. Higher velocity signals can be displayed without aliasing. A disadvantage is the ambiguity in the spatial location of the sample volume. Multiple sample volumes are displayed, but since the vessel of interest has been identified, the unwanted sample volumes can be discounted or ignored.

High Q: A measurements setup used to select the number of heart cycles that the system uses to calculate the values selected in the Doppler Results Display.

HIGH QR: A control that initiates the display of the peak trace on the Doppler waveform.

High Q Automatic Doppler Analysis: Process of automatically detecting, computing, and displaying the calculation of specified Doppler parameters.

Hip Angle: An optional measurement tool that provides hip angle calculations used to evaluate infant hip dysplasia.

Home: A key used to move the cursor to the home position.

Host Table: A list of all devices connected to a specific network. It contains the alias name, the DICOM title, the Model ID, the IP address, the port number, and the subnet name of all the devices on the network.

HTTP: Hypertext Transfer Protocol. Web servers and Web browsers communicate using HTTP. It is a special language used for the request and transfer of hypertext documents over the Web.

Image: An ultrasound display.

Image Info: A display setup. Turns on or off the display of image information for the active imaging mode. Image information consists of display-related, control settings.

Image Management: A system option that provides image management and review of images from optical disk, network, or World Wide Web.

Image Management Configuration: A group of Image Management system setups available on the Directory of Image Management Setup Options.

Image Management Network Administration: Available from the Configuration Files selection on the Directory of Image Management Setup Options.

Images Per View: A capture length setting in the Acquisition Parameters setups for clips that sets the number of images acquired per view.

Info: With the DVS option, a selection on the patient directory used to display information about the selected patient, study, series, or image.

Install: A selection on the Configuration Files screen. It copies files from an optical disk to the hard disk, and it overwrites the host table on the hard disk with the one on the optical disk.

Institution: A display setup used to enter the name of the hospital, clinic, or institution.

Intensity: A measure of the amount of acoustic energy flowing through a unit area that is perpendicular to the direction of the energy flow. Expressed as power per unit area in units of Watts/ cm^2. Intensity can be averaged over space, over time, or expressed as peak values over space or time.

Internal Printer: A peripheral setup used to select the type of internal printer that is installed.

Internal VCR: A peripherals setup used to select the type of VCR installed on top of the system.

Internet Protocol (IP): The IP portion of TCP/IP, which is a standard protocol for the Internet. Every computer on the Internet has a unique IP address. The system administrator controls IP addresses for the devices on the network.

Intracavity Transducer (ICT): A scanhead which is inserted into the rectum or vagina for imaging in those areas. Typically used to study prostate or ovaries.

Intravaginal Transducer (IVT): Scanhead which is inserted into the vagina, used for OB/GYN applications.

INVERT: A control used to invert the orientation of the Doppler image relative to the baseline.

I–RGB: Interlaced, red, green, and blue video. The system has a rear panel connector for video devices that use this type of video.

Isovolumic Relaxation Time (IVRT): Isovolumic relaxation time occurs between aortic valve closure and mitral valve opening. IVRT is used as an index of diastolic function.

Joint Photographic Experts Group (JPEG): A standards body that developed the JPEG image-encoding format. JPEG images are platform independent and specially compressed for high-speed digital communication. The JPEG format is widely used in current graphical browsers, such as those used with the WebLink option.

LABEL VL: A softkey used to display a dialog box into which you enter a volume label, designate an acquisition geometry, store the volume, or cancel the acquisition.

Landscape: A film orientation. See also “Portrait.”

Left Ventricular Ejection Fraction: A cardiology measurement protocol used to calculate several 2D performance characteristics related to cardiac function.

Left Ventricular Mass: A cardiology measurement protocol used to calculate the left ventricular mass from area and length measurements.

Left Ventricular Volume Area/ Length Protocol: A cardiology measurement protocol used to calculate left ventricular volume and other parameters. It is an alternative to the Simpson's protocol.

Lightbar Brightness Control: A monitor module control used to adjust the brightness of the lightbar.

Linear Array: Scanhead in which a large number of long, narrow elements are placed side by side. A subset of the elements is used to produce each column of data. This subset called the aperture, is shifted across the scanhead to produce an array of parallel columns which form a rectangular image on the display.

Line Density: A 2D menu item used to vary the line density of the 2D display. Line density refers to the number of lines of ultrasound data that make up the image.

Live Image: A Peripherals setup used to select the live image as the source for the VCR and printer.

Load: With the DVS option, a selection in the patient directory used to load images for review.

Loop: Method of playing back Cineloop sequence. The loop plays from the beginning to end and then resets back to the beginning. See also "Sweep."

Loop Mode: An Acquisition Parameters setup used to select R to R, systole, or first half.

Lossy Compression: (1) Lossy compression is a type of JPEG compression. Lossy means that a decompressed image is not the same image as the original. JPEG, the compression algorithm used with the Web-Link option, uses a lossy compression algorithm. The difference between the original image and one that has been compressed and then decompressed for display is usually not discernible to the human eye. (2) Compression settings of low, medium, and high can be selected in the Acquisition Parameters setups for clips. See also "Compression."

L/R INVERT: A control used to invert the horizontal orientation of the 2D image.

M-line: In M-mode, a line on the 2D display representing the 2D line from which the M-mode display is acquired.

M MODE: A control used to start M-mode acquisition and display.

M-mode: The "M" stands for motion. The motion occurs over time, which is represented by a scrolling M-mode display.

Magazine: A setting for the Destination setup on the B&W and Color Printers screens. It describes a film that is taken to a developer for processing. See also "Processor" and "Destination."

Mask: The IP subnet mask or address that identifies the subnet. The system administrator controls subnet masks. See also "Subnet Name."

Mean Tr: A superkey that turns the High Q mean trace on or off.

Meas/Edit: A selection on the Review Images screen used to edit the annotation on a stored image or measure a stored image.

Measurement Protocol: A series of parameters and their associated calculations associated with a specific application or clinical option (for example, Fetal Biometry). See also "Acquisition Protocol."

Menu: A list of protocols or adjustable system parameters.

MENU: A category of controls used to display menus of adjustable system parameters related to the controls.

Microphone: A key used to turn the system microphone on or off. The system microphone is connected to the rear of the monitor module and is located directly above the video monitor.

Model ID: An entry in the host table that denotes the device type, in this case the ultrasound system: for example, ATL_HDI3000_v1.

Modify Study Data Lists: A group of User Options in the Directory of Image Management Setup Options used to modify the content of the study data list available in patient data entry.

Move ✣: On the image review toolbar, select to move the toolbar with the trackball.

Multi-Image Camera (MIC): One of several devices offered with an ultrasound system that allows the user to record images on a permanent medium. They can accommodate up to six images on one piece of film. The film is a plastic transparent sheet which can be held up to a light for study much like an x-ray.

Multiplane Transesophageal (MPT) Scanhead: A transesophageal scanhead that allows a circular continuum of tomographic images within a 180-degree arc without moving the probe.

National Television Standards Committee (NTSC): Standard video signal for all broadcast TV in the U.S. The European video standard is Phase Alternating Line (PAL).

NET/DISK MENU: A control used to display the Net/Disk menu.

Network Administration: A group of setups available on the Directory of Image Management Setup Options.

Network Configuration: A group of Image Management setups available on the Directory of Image Management Setup Options.

Next " |: On the image review toolbar, select to display the next image in the next heart cycle or second clip.

NI–RGB: Non-interlaced, red, green, and blue video. The system has a connector on the rear panel for devices that use this type of video.

Number of Copies to Print: A Printers setup that sets the number of B&W and color copies of an image to print.

Number of Timers: An Image Management General Option setup used to select the number of timers available during acquisition. See also "TIMERS."

OB Calculations: A group of setups on the Directory of Setups Options. With OB Calculations setups, you can create, view, or modify fetal tables and equations.

Occipital Frontal Diameter (OFD): Occipital frontal diameter is a fetal biometric measurement used to calculate ultrasound age.

On-Screen Video: A Peripherals setup used to select the on-screen display as the video source for the VCR and the hardcopy device.

ON/STANDBY: The switch located on the left side of the system that is used to initialize the system.

Operator Prompts: An Image Management General Option setup used to enable or disable acquisition protocol operator prompts.

Optical Density: A measure of film blackness. A nominal range used in the Printers setups is from 0 to 400. For example: a maximum density of 400 prints the darkest parts of the image black, and a setting less than 400 prints the darkest parts of the image less than black or some shade of gray; a minimum density of 0 prints the lightest parts of the image white, and a setting more than 0 prints the lightest parts of the image darker than white or some shade of gray. The borders of the cells and empty cells can be set to print from light to dark (nominally 0 to 400), depending upon the density values set for border density and empty density.

Optical Disk: A storage device used to store images. Information is stored and read using a laser. Optical disks can store large quantities of information and are not subject to data degradation or erasure by magnetic fields as are hard disks and floppy disks. The optical disk drive is located on the front of the ultrasound system. An optical disk has a capacity that depends upon image type. Color images require more space than gray-scale images.

OPTIMIZATION: A control used to optimize the 2D, Color, and Power image for patient type. Also useful for 2D and Flow Contrast Specific Imaging.

Orientation: A setup on the B&W and Color Printers screens that has two settings, based on the selected film format. Orientation settings are Portrait and Landscape.

OSP Input Port: A peripherals setup used to select the on-screen programming (OSP) input port for an external printer. If an external printer is not connected to the OSP input port, then it is not used.

OUTPUT: A control used to determine the amount of ultrasound acoustic power produced by the transducer measured in watts per square centimeter.

Page ←: On the keyboard, allows you to move through the review images or the exam directory.

Page →: On the keyboard, allows you to move through the review images or the exam directory.

Paper: A type of film. See also "Clear" and "Blue."

PARAMS: A control used to display the Exam Parameters dialog box from which you can set the capture format, ECG trigger, compression, and capture length of clips in freeform acquisition. See also "Configure Clips."

Partial Exams: Exams that have been designated for several destinations and have not yet been sent to all of the destinations. In the hard disk exam directory, partial appears as a status under Sent on the right side of the screen.

Patient Data: (1) Includes image, graphics, and other information associated with a specific patient from an ultrasound or other type of medical exam. (2) A key on the system keyboard that displays the patient data entry form for creation of a patient file. The name and ID of the patient along with pertinent exam information, including birth date, height, weight, gender, and previous exam data.

Patient File: A file created when you enter patient data. Any images stored during the exam are included in the patient file.

PAUSE: A softkey used to interrupt the clip capture. See also "RESUME."

Peak: A stage of an acquisition protocol characterized by the acquisition of peak-stress cardiac images at specified views.

Peak Systolic Frequency: A characteristic parameter of the Doppler waveform used in High Q measurements.

Peak Systolic Velocity: A characteristic parameter of the Doppler waveform used in High Q measurements.

Pencil Probe: A device that includes two transducer elements. In the CW version, one transmits the sound wave, the other receives the echo; in the PW version, one element transmits and receives.

Pending Exams: Exams on the hard disk that have not been transferred to the optical disk or to other archive devices. In the hard disk exam directory, pending appears as a status under Sent on the right side of the screen. See also "Auto Send" and "Portable Exams."

Percent Area Reduction: An optional measurement tool used to calculate the percentage of area reduction in a vessel.

Percent Diameter Reduction: An optional measurement tool used to calculate the percentage of diameter reduction in a vessel.

Peripherals: (1) A group of system setups that set the input and output ports. (2) Device used with the ultrasound system to extend the capabilities of the system. Examples include printers, cameras, and VCRs.

Persistence: A selection on the 2D/MMode menu. Persistence is a smoothing or frame averaging technique.

Pharmacologic: An acquisition protocol consisting of four stages.

Phase Alternating Line (PAL): European video standard.

Phased Array: A scanhead type with an array of transducer elements that are electronically time-phase coordinated to generate a focused and steerable wavefront.

Phono/Channel B: Phonocardiography (PCG) or phono is the recording of heart sounds and their graphic display on the system video monitor.

Physio: A system menu with selections for the configuration of the physiological displays. Also a group of setup options. Physiological displays include ECG, high-level ECG, auxiliary, respiratory, pulse, and phono.

PHYSIO MENU: A control used to display the Physio menu.

PLAY: A softkey used to start VCR playback.

Play/Pause " : On the image review toolbar, select to play or pause the review clip.

Play Faster Y : On the image review toolbar, select to play the review clip faster.

Play Slower B : On the image review toolbar, select to play the review clip faster.

Port #: A number that identifies the source or destination of the data. The port number is included as part of the host table. The port number is the logical TCP port. ATL uses 104. See the vendor's Conformance Specification for the port number of the device.

Portable exam: is a condition that exists when the system powers up and detects that all devices on the network are down, unresponsive, or not connected to the network. The exams are listed as pending or partial until the system successfully sends them to all of the archive devices.

Portrait: A film orientation. See also "Landscape."

Post: A stage of an acquisition protocol characterized by the acquisition of specified post-stress cardiac views.

Power Harmonics: Power Harmonic Imaging uses a color overlay to display the power of the Doppler signal returned from the contrast agent at the harmonic frequency

Power Motion Imaging (PMI): A Power imaging mode that aids in the visualization of regional cardiac wall motion.

P-R Interval: The interval that exists between the P-wave (atrial contraction) and the R-wave (ventricular contraction). This interval is used as an index of diastolic function.

Previous |A : On the image review toolbar, select to display the previous image in the review clip.

PREVIEW: A softkey used to preview the 3D volume acquisition on the ultrasound system monitor, using the Integrated 3DI ultrasound feature.

PRINT: A control used toinitiate a hardcopy print. Also the process by which an image or an exam is printed or stored.

Print All: An option for the Print Environment setup. All images that are stored are automatically tagged for printing.

Print Environment: A General Options setup that allows you to have the system automatically tag for printing all of the images that you store, or you can manually select and tag images for printing. See also "Print All."

Print Local: (1) A setting in the General Options for the Use Print Button To setup. Print Local sets the PRINT control for local printing. (2) A superkey that prints the current image to the internal local printer, stores images on the hard disk, or prints exams to the network devices, depending upon the setting of the Use Print Button To setup.

Printed Image Destination: A Printer system setup used to specify the type of printer to which images are sent.

Printer: A heading for a list of the printers on the B&W Printers and Color Printers screens. The list contains the available printers as specified in the host table. You select one based on your requirements.

Printer Density: A setup on the B&W and Color Printers screens that has various settings, based on the selected printer. The densities refer to optical density. See also "Optical Density."

Printer Selection: A group of Image Management setups available from the Directory of Image Management Setup Options.

PRIORITY: A control that establishes the threshold value at which the 2D gray-scale echo information is considered strong enough to indicate a solid structure such as a heart wall, rather than blood flow, even though that structure may be moving.

Processor: A setting for the Destination setup on the B&W and Color Printers screens. It describes a film cassette with a built-in developer. See also "Destination" and "Magazine."

Prospective: A setting in the Acquisition Parameters for capture mode. After pressing the CAPTURE softkey, the next four consecutive cardiac cycles are captured.

PROTOCOL: A control used to display the Protocol Start dialog box from which you select the appropriate protocol and start it. See also "Acquisition Protocol" and "Measurement Protocol."

Proximal Isovelocity Surface Area (PISA): A regurgitant flow performance characteristic in the Doppler cardiac measurement protocols (tricuspid and mitral valve).

Pulsatility Index: A Doppler Result Display item in the Measurements setups. It is used to analyze the pulsatile qualities of vascular blood flow. It is equal to peak systole minus minimum diastole divided by the time-average peak velocity or frequency.

Pulse/Channel A: Pulse refers to the graphic recording of pressure changes related to blood flow.

Pulse Inversion Imaging: An imaging technique that uses a pair of inverted ultrasound pulses. The resulting echo is a harmonic of the transmitted fundamental frequency. Pulse inversion harmonics is used with contrast specific imaging.

Pulse Repetition Frequency (PRF): The number of ultrasound pulses per second, measured in Hertz.

PULSED: A control used to start and stop pulsed-wave Doppler imaging.

Pwr Bg: A superkey used to turn the Power imaging background on or off.

PWR IMG: A control used to start and stop Power Imaging.

PWR MENU: A control used to display a menu of Power Imaging parameters.

QP/QS: Pulmonary–Systemic flow ratio. Pulmonary flow (QP) is calculated from the right ventricular outflow tract (RVOT) and systemic flow (QS) is calculated from the left ventricular outflow tract (LVOT).

Quad: A capture format setting in the Acquisition Parameters setups for clips that sets the display format for captured images.

Quick Save: A key that allows you to setup and then save a range of Tissue Specific preset setups for a specific application and scanhead.

Reading Physician: An entry in the study data; it can be edited in the Study Data List Modifier.

Recall: The process by which you load stored patient exam data from a disk or file server onto the ultrasound system for review. Review may also be used to refer to this process. See also "Review."

RECORD: A control that starts a VCR recording, or during recording pauses the recording.

Referring Physician: An entry in the study data; it can be edited in the Study Data List Modifier.

REJECT: A softkey used to delete an acquired clip and return to imaging.

Replace: On the Review Images screen, it is used to replace images that were stored on the hard disk with new images. When you replace images, the film format icons will change to reflect your changes.

Report: A key used to display the patient report.

Report Printer: Optional device connected to the ultrasound system to print analysis reports or graphs onto paper.

Reprinting: When you tag images for printing, an electronic tag is attached to the image. When the image is printed, the printer erases this electronic tag. If you wish to print this image again, then the image must be retagged or reprinted. This is done by selecting the image and pressing the PRINT control or the Print Local Superkey. See also "Retagging."

Resolution: An item used to select the inter-frame spacing applied to the acquisition of the 2D Cineloop review series that is used for the 3D volume rendering.

Rest: A stage of an acquisition protocol characterized by the acquisition of specified pre-stress cardiac views.

Restarting an Exam: Refers to the process of adding images to the current patient file. Only the current patient file can be restarted. Exams on the optical disk or exams that have been archived to the network cannot be restarted.

Restore: A selection on the Configuration Files screen. It restores the previous version of the configuration files.

RESUME: A softkey used to resume 3D acquisition. With the DVS option, resumes image capture. See also "PAUSE."

Retagging: When you tag images for printing, an electronic tag is attached to the image. When the image is printed, the printer resets this electronic tag. If you wish to print an image again, then the image must be retagged. Highlighting an exam and pressing the PRINT control will retag the exam. See also "Reprinting."

Retrospective: A setting in the Acquisition Parameters for capture mode. The four cardiac cycles before the CAPTURE softkey is pressed are captured.

Review: Refers to the process by which you load stored patient exam data from a disk or file server onto the ultrasound system for review. See also "Recall."

REVIEW: A control used to review the current patient's images.The REVIEW control is also used to return to the Review Images screen after measuring or editing an image.

Review Format: An Image Management system setup that allows you to select the review format.

Review Images: On the Exam Directory, displays the Review Images screen. Review Images is not available if more than one exam is selected, and Review Images is only available for the hard disk.

Review Images Screen: Displays the images in the current patient exam. From the Review Images screen, you can perform the following functions: delete images, replace images, tag images for printing, start the measurement or edit function, select all images, display the exam directory, and close.

REWIND: A softkey used to rewind the videotape.

RGB: Red–Green–Blue video signal format, suitable for driving an RGB monitor or other external device.

R/L Vent Protocol: A cardiology measurement protocol that provides 2D and M-mode performance calculations.

R-R Cycle: An auto-trim selection used to display all of the frames captured between two successive R-waves.

Sample Volume: The listening region or the volume of blood being sampled by a beam of ultrasound during pulsed Doppler. Sample volume size is defined by the length of the pulse and the width of the ultrasound beam.

Save: The process by which you store the screen display and associated patient exam data to a device. See also "Store" and "Archive Device."

SCALE: A control used to adjust the velocity or frequency scale or range of the Color, Power, or Doppler display.

Scanhead: (1) A device used to transmit, receive, and transduce echo information. (2) A key used to display a screen from which you select a scanhead.

Scroll A | " : On the image review toolbar, used to enable you to scroll through the review images using the trackball.

SEC WIDTH: A system control used to adjust the width of the 2D sector.

Select: The process by which you choose specific images or exams from a list. This process usually requires manipulation of the trackball to highlight the image or exam and pressing the SELECT control. See also "Select All."

SELECT: A control used to set a cursor location or initiate an action.

Select All: A selection on the Review Images screen and the Exam Directory screen used to select all of the images or exams at once. See also "Select."

Send Images During Exam: An Image Management General Options setup used to determine whether stored images are sent to the archive device manually, after each image, or at the end of the exam.

Sensitivity: A selection on the Color and Power menus used to vary the number of pulses used to acquire data along a single column to derive the velocity and the variance of blood flow, before going on to the next column. The number of these acquisition columns in each physical column is the ensemble size.

Serial Output Port: A peripheral setup used to select the serial output port on the rear of the system to configure it for data transfer to a printer or a personal computer.

Series: With the DVS option, an image or a collection of images. See also "Study."

Set Home: A key used to set the home position of the annotation cursor.

Setups: A key used to access the system and Tissue Specific preset setups.

SH Pos: A key used to display a scanhead marker that can be located on a body mark.

Simpson's Protocol: A calculations protocol used to calculate left ventricular volume from measurements in two scan planes.

Simult: A key used to initiate a simultaneous imaging mode in which two different types of data acquisition and display can take place at the same time. For example, 2D and M-mode can be updating together rather than one being frozen while the other is live.

Slice: An item on the Cineloop menu used to select the slice thickness for the 3D image rendering.

Slide Control: A control used for TGC adjustment.

Software Setups: Includes temporary options used by an ATL representative to load software features.

Solid: A Power Imaging background setting.

Sonographer: An entry in the study data; it can be edited in the Study Data List Modifier.

Speakers: A peripherals setup used to turn the speakers on or off.

Speed: A superkey used to change scrolling sweep speed.

Spool: An acronym for Synchronous Peripheral Operation On-Line. It is a process by which data is transmitted from one device to another in the background. Background transmission is transparent to you and your operation of the system. The spooler allows you to continue the exam after a print or store operation was initiated without waiting for the completion of the operation. See also "Store Images During Exam."

Standby: The state of the system that exists when the circuit breaker is on and the power switch, also referred to as the ON/STANDBY switch, is set to standby. In this state, setting the power switch to ON turns on the system and imaging can be performed. Unless you plan on moving the system, setting the power switch to STANDBY is sufficient when you are finished using the system. If you plan to move the system, not only should the power switch be set to STANDBY, but also the circuit breaker should be set to OFF.

Static Probe: Device used solely for CW Doppler or for PW Doppler.

STEER: A control used to adjust the steering angle of the linear display.

STOP: A softkey used to stop the VCR playback or recording.

Store: The process by which you transfer an image from one medium to another. For example: you store an image to the hard disk from image memory. Depending upon the system environment or system configuration, the image can then be stored to the optical disk.

Store Images During Exam: A setup used to set the system to automatically store images to the optical disk and to network devices.

STORE VL: A softkey used to store the 2D Cineloop data set onto the Advanced 3DI Workstation, without entering volume labeling information.

Stored Loop Size: An Image Management system setup used to select the size (number of images) of a stored loop.

Streaming: The transfer of image data directly from the hard disk to the video display.

Stroke Volume: A cardiac calculation displayed in the Cardiac Output measurement tool results. It is also a 2D and Doppler cardiac calculation.

Study: With the DVS option, the date denotes a study and comprises one or more series of images. See also "Series."

Study Title: An entry in the study data; it can be edited in the Study Data List Modifier.

Subnet Name: The name assigned by the system administrator to a subnet. A subnet designates a network within a larger network. A subnet is defined by applying a bit mask, the subnet mask, to the IP address. The host table in the network configuration files requires the use of subnet names and masks.

Superkey: A key used with another key to quickly perform a function normally done from a menu.

SV SIZE: A control used to adjust the Doppler sample volume size.

SVID: The system has a connector on the rear panel for devices that use S video. For example: a SVHS VCR.

S-VID Input Port: A peripherals setup. Selects the VCR or Acquisition Module connected to the S-VID input port on the rear of the system. If neither of these is connected to the S-VID input port, then it is not used.

Sweep: Method of playing back Cineloop data such that the loop plays from beginning to end and then from end to beginning. See also "Loop."

Sweep Speed: A selection on the Doppler and 2D/MMode menus used to set the rate of scrolling update.

System Defaults: A selection in System Setups used to return the system setups to their default values.

System Setups: Parameters which can be set by the user.

Systole/Diastole (S/D): A Doppler Results Display item in the Measurements setups. S/D is equal to peak systole divided by either minimum or end diastole, depending upon the Doppler Results Display item selected.

Systole Only: An auto-trim selection used to display only the systolic frames in a clip.

Tag Print: On the Review Images screen, tags individual images for printing. An asterisk ***** on an image indicates a tagged image. To untag images, select the images and select Tag Print again. See also "Untagging Images."

TCP/IP: A protocol used over the Internet to provide reliable, ordered, end-to-end transmission of data.

TEE: See "Transesophageal Scanhead."

Temporary Options: Software setups used by an ATL representative to load temporary software features.

Text: A key used to enter information into the text area of the video display.

TEXT A, B, C, D: Keys used to display exam-specific text.

TGC Display: A display setup used to turns on or off the TGC display.

TGC Slide Controls: Controls used to adjust the TGC.

Thermal Index: A displayed index that provides information about the conditions that exist that might lead to an increase in temperature at the surface of the body, within the body tissue, or at the point of focus of the ultrasound beam on bone.

Thickening Fraction: A cardiology calculation.

Three Stage Bicycle: An acquisition protocol consisting of three stages (rest, peak, post).

TI (Thermal Index): A superkey used to cycle between the thermal output display indices.

TI Help: A key used to display an explanation of the TI and MI output display standard.

Time: (1) A display setup used to select am, pm, or the 24-hour clock. European countries use the 24-hour clock, the US uses am/pm. Use the keyboard to enter the time. (2) A capture length setting in the Acquisition Parameters setups for clips that sets the acquisition time for each clip. See also "Capture Length."

TIMERS: A control used to start the timer, cycle through the available timers, and reset the timer.

Time-Averaged Mean Velocity: A Doppler Result Display item in the Measurements setups.

Time-Averaged Peak Velocity or Frequency: A Doppler Result Display item in the Measurements setups.

Time Gain Compensation (TGC): A process of changing signal amplification to compensate for ultrasound beam attenuation, transducer focusing, and pulse frequency. The purpose of TGC is to permit display images of equal echogenicity (echo generating capability) to appear with equal brightness regardless of depth. Echoes from greater depths require more gain than echoes from shallower depths.

Time/Slope: A measurement tool used for scrolling displays. It can be used to measure distance, time and slope.

Tint: A Power Imaging background setting.

Tissue Doppler Imaging (TDI): A Color Doppler imaging technique used primarily in cardiology to display ventricular wall motion. The high-amplitude, low-velocity Doppler signal from tissue motion is processed and overlayed on the 2D or M-mode displays. Tissue Doppler Imaging can also be incorporated into the Doppler imaging display.

Tissue Harmonic Imaging: A fundamental ultrasound signal is transmitted at a broadband of low frequencies. The signal resonates off tissue in the body at twice the transmitted frequency. The higher frequency signal travels one way from the tissue to the scanhead. Because the higher frequency signal travels half the round trip distance and does not include fundamental frequencies, it undergoes less attenuation and has less artifactual data. THI is a cardiology clinical option useful for difficult-to-image patients.

Tissue Specific Preset Setups: A group of setups that can be customized for specific applications.

Title: A key used to enter information into the title area of the video display.

TOOLBAR: A control used to remove or display the image review toolbar.

TOP/BOT: A control used to change the vertical orientation of the 2D display.

Tr Dir: A superkey used to select the trace direction for the High Q measurement.

Trace By Points: A measurement type used to measure the circumference and area of an object.

Trackball: A control used to move objects on the monitor.

Trackball Select Menu: Annotation that appears on the monitor, directly above the 2D image, indicating the trackball function.

Transabdominal Diameter (TAD): A fetal biometric measurement used to calculate ultrasound age.

Transesophageal Scanhead (TEE): System scanhead. The transducer is located at the end of a long flexible gastroscope, which is inserted through the patient's mouth to image from within the esophagus**.**

Transfer Control Protocol (TCP): The TCP portion of TCP/IP, which is the standard protocol for the Internet. TCP ensures that the data arrives in the correct order.

Transferring Setups: Copying setups to an optical disk and then copying those setups to another system.

Trim Cursors: Display elements used to define a portion of the Cineloop review sequence for review.

Triple Mode: A mode in which Doppler, 2D, and Color imaging are updating simultaneously.

Two Stage Full Disclosure: An acquisition protocol consisting of two stages (rest and post) in which multiple successive ECG-triggered cardiac cycles are continuously acquired until acquisition is paused or stopped.

Two Stage Continuous: An acquisition protocol consisting of two stages (rest and post).

Ultrasound Age: Pregnancy dating derived from an ultrasound measurement that equates to an average size for a specific time in pregnancy.

Ultrasound System Net ID: Identifies the network location of the ultrasound system.

Uncompressed: A compression setting in the Acquisition Parameters setups for clips. See also "Compression."

Untagging Images: Done with the Tag Print selection on the Review Images screen. Select the tagged images and then select Tag Print on the Review Images screen.

UPDATE: A control used tochange the method by which the system updates the image display, alternating between duplex and simultaneous methods.

Upgrade: A selection on the Configuration Files screen used to overwrite files on the hard disk with configuration files from the optical disk.

Use Print Button To: A system setup used to choose how the PRINT control will operate.

User Number for Print to Optical Disk: Sets an individual identifier for users of the system. The range is from 1 to 99. A user number sets a preferred printer setup for a particular user.

User Options: Refers to a group of setup categories available on the Directory of Image Management Setup Options.

Variance: Difference in blood flow within a given number of samples. Indicates change in blood flow or possible turbulence due to an obstruction. Variance can be mapped to a color, such as green, in order to be seen clearly during an exam.

VCR & Hardcopy Source: A category of setups. Live image and On-Screen Video are the setups.

Video: A superkey used to change the video source to the video monitor.

Views: An item on the Cineloop menu used to select the number of images from which the 3D image is rendered.

Velocity Time Integral (VTI): A High Q automatic Doppler measurement parameter.

VOLUME: A control used to adjust the audio volume of the system speakers.

Volume Flow: The amount of fluid moving through a vessel, expressed in units of volume per units of time.

Volume Method: A measurements setup used to select a method for calculating volume of a shape.

WebLink: A setup used to turn the WebLink option on or off.

WebLink Connectivity: A configurable software option. A Web server in the system is configured or turned on when you purchase the WebLink option. With the WebLink option configured, you can use a client computer at a location remote or removed from the ultrasound system location to view images that are on the ultrasound system hard disk. See also “World Wide Web” and “WebLink.”

World Wide Web: Also referred to as the Web or WWW, is based on a computer client/server model. When you use the Web, you are using two programs, the client program and the server program. The client program is the program that is running on your computer. It displays the information on your screen, takes your keystrokes and your mouse clicks, and retrieves the information that you request from the server. The WebLink server program is in the ultrasound system. See also “WebLink Connectivity.”

Yolk Sac: A measurement in the early gestation protocol used to estimate of menstrual age up to about 7 weeks.

ZONES: A control used to determine the number of focal zones and the distance between them.

ZOOM: A control used to zoom the image and pan areas of the image with the trackball.

Acronyms and Abbreviations

2D	Two Dimensional
3D	Three Dimensional
3DI	Three Dimensional Integrated
A	Artery
A2C	Apical Two Chamber
A4C	Apical Four Chamber
A5C	Apical Five Chamber
A/L	Area/Length
ABD	Abdomen
AC	Abdominal Circumference
ACA	Anterior Cerebral Artery
ACC	Acceleration
A. CARD	Adult Cardiology
A. DIAM	Atrial Diameter
ADV	Advanced
AFI	Amniotic Fluid Index
AFV	Amniotic Fluid Volume
AIUM	American Institute of Ultrasound in Medicine
ALAX	Apical Long Axis
AMP	Amplitude
ANG	Angle
ANT	Anterior
AO	Aorta
AO/LA	Aorta/Left Atrium
AoV	Aortic Valve
AP	Anterior Posterior
APD	Anterior Posterior Diameter
APTD	Anterior Posterior Thorax Diameter
AP&I	Acoustic Power and Intensity
ARD	Atrial Reversal Duration
ARV	Atrial Reversal Velocity
ASC	Ascending
AT	Acceleration Time
ATL	Advanced Technology Laboratories
AUA	Average Ultrasound Age
AV	Average
AV	Aortic Valve
AVA	Aortic Valve Area
BG	Background
BIOS	Biosponder
BOT	Bottom
BPD	Bi–Parietal Diameter
BPDa	Area Corrected Bi–Parietal Diameter
BIFUR	Bifurcation
BSA	Body Surface Area
C	Color
CA	Curved Array
CALCS	Calculations
CARD	Cardiology
CBD	Common Bile Duct

CCA	Common Carotid Artery
CD PLAX	Color Doppler Parasternal Long Axis
CEREB	Cerebellum
CFA	Common Femoral Artery
CI	Cardiac Index
CI	Cephalic Index
CINE	Cineloop
CIRC	Circulation
CIST	Cisterna
CLA	Curved Linear Array
CLAV	Clavicle
cm	Centimeters
CMAG	Cisterna Magna
CO	Cardiac Output
COL	Color
COMPRESS	Compression
COR	Correction
CPA	Color Power Angio
CPU	Central Processing Unit
CRL	Crown Rump Length
CSA	Cross Sectional Area
CSI	Contrast Specific Imaging
C-SPINE	Cervical Spine
CSR	Customer Service Representative
CTRL	Control
CW	Continuous Wave
D	Diameter
(D)	Diastole
dB	Decibel
DCE	Dynamic Contrast Enhancement
DECUB	Decubitus
DEFF	Data Exchange File Format
DEL	Delete
DEL IMG	Delete Image
DESC	Descending
DIAM	Diameter
DIAS	Diastolic
DIR	Direction
DISP	Display
DIST	Distal
DICOM	Digital Imaging and Communications in Medicine
DMD	Dynamic Motion Differentiation
DSR	Data Storage and Retrieval
DT	Deceleration Time
DUCT ART	Ductus Arteriosus
DUCT VEN	Ductus Venous
Dyn Rng	Dyamic Range
ECA	External Carotid Artery
ECG	Electrocardiogram
ECHO	Echocardiography
EDD	Estimated Date of Delivery
EDV/F	End Diastolic Velocity/ Frequency

EF	Ejection Fraction
EFW	Estimated Fetal Weight
EMI	Electro–Magnetic Interference
ENDO	Endocardium
E-NET	Ethernet
EPI	Epicardium
EPSS	E Point Septal Separation
ERO	Effective Regurgitant Orifice
ESP	Enhanced Signal Processing
ESV	End Systolic Volume
EXT	External
FDA	Food and Drug Administration
FEM	Femoral
FFT	Fast Fourier Transform
FIB	Fibula
FL	Femur Length
FOOTSW	Footswitch
FRAC	Fractional
FRI	Frame Rate Interval
FUND	Fundamental
GA	Gestational Age
GB	Gall Bladder
GEN	General
GEST	Gestation
GS	Gestational Sac
HC	Head Circumference
HDI	High Definition Imaging
HFR	High Frame Rate
HPRF	High Pulse Repetition Frequency
HIGH V	High Velocity
HR	Heart Rate
HRDCPY	Hard Copy
HRES	Higher Resolution
HRM	Harmonic
HTTP	Hypertext Transfer Protocol
HUM	Humerus
I	Interlaced
ICA	Internal Carotid Artery
ICT	Intracavity Transducer
IMEM	Image Memory
INF	Inferior
INT	Interval
IOD	Inner Orbital Diameter
IP	Internet Protocol
IQ	Image Quality
IVC	Inferior Vena Cava
IVRT	Isovolumic Relaxation Time
IVS	Interventricular Septum
IVT	Intravaginal Transducer
JPEG	Joint Photographic Experts Group
L	Length
LA	Linear Array
LA	Left Atrium
LAT	Lateral

LATV	Lateral Vein
LCPNL	Lower Control Panel
LMP	Last Menstrual Period
LOW V	Low Velocity
L/R	Left/Right
L-SPINE	Lumbar Spine
LT	Left
LUS	Lower Uterine Segment
LV	Left Ventricle
LVD	Left Ventricle Distance
LVET	Left Ventricle Ejection Time
LVOT	Left Ventricular Outflow Tract
LVPW	Left Ventricular Posterior Wall
M	Motion
MA	Menstrual Age
MCA	Middle Cerebral Artery
MDV	Minimum Diastolic Velocity
MEAS	Measure
MED V	Medium Velocity
MI	Mechanical Index
MIC	Microphone
MIC	Multi–Image Camera
MID	Middle
M M	Motion Mode
MO	Magneto–Optical
MPA	Main Pulmonary Artery
MPHLANX5	Middle Phalanx Fifth Digit
MPPS	Modality Performed Procedure Step
MPT	Multiplane Transesophageal
MR	Mitral Regurgitation
MV	Mitral Valve
NI	Non-interlaced
NTSC	National Television Standards Committee
NUCH	Nuchal Fold
OB	Obstetrics
ODRIVE	Optical Disk Drive
OEM	Original Equipment Manufacturer
OFD	Occipital–Frontal Diameter
OOD	Outer Orbital Diameter
ORBIT1	Orbit 1
ORBIT2	Orbit 2
OUTFL	Outflow
PA	Phased Array
PAL	Phased Alternating Line
PANC	Pancreas
PAP	Papillary
PAPA	Pediatric Adult Phased Array
PARAMS	Parameters
PCA	Posterior Communicating Artery
PCG	Phonocardiogram
PED	Pediatric
PELV	Pelvis

PEN	Penetration
PEP	Pre-Ejection Period
PET	Pre-Ejection Time
PG	Pressure Gradient
PHT	Pressure Half Time
PI	Pulmonary Insufficiency
PI	Pulsatility Index
PISA	Proximal Isovelocity Surface Area
PLAX	Parasternal Long Axis
PMI	Power Motion Imaging
POP	Popliteal
PREEJECT	Pre-Ejection
PRF	Pulse Repetition Frequency
PRI	Pulse Repetition Interval
PROX	Proximal
PSAX	Parasternal Short Axis
PTI	Pressure Time Integral
PV	Peripheral Vascular
PV	Pulmonic Valve
PW	Pulsed Wave
PWR	Power
PWR1	Power 1
PWR2	Power 2
Q	Quadrant
QP	Pulmonic Stroke Volume
QS	Systemic Stroke Volume
RA	Right Atrium
RAD	Radius
REN L	Renal Length
REN AP	Renal Anterior Posterior
REN PELV	Renal Pelvis
RES	Resolution
RF	Radio Frequency
RGBS	Red, Green, Blue, Sync
RI	Resistive Index
ROI	Region of Interest
RPEP	Right Ventricle Pre-Ejection Period
RT	Right
RTDA	Real-Time Doppler Analysis
RV	Right Ventricle
RVET	Right Ventricle Ejection Time
RVID	Right Ventricle Inner Dimension
RVIT	Right Ventricular Inflow Tract
RVOT	Right Ventricular Outflow Tract
RVSP	Right Ventricle Systolic Pressure
(S)	Systole
SAG	Sagittal
SAX	Short Axis
SC	Storage Commit
SCW	Steered CW
SD	Standard Deviation
SFA	Saphenous Femoral Artery

S/H	Scanhead
SMA	Superior Mesenteric Artery
SPKR	Speaker
SSN	Suprasternal Notch
SUBC 4C	Subcostal Four Chamber
SUP	Superior
SV	Sample Volume
SV	Stroke Volume
SYS	Systolic
TAD	Trans–Abdominal Diameter
TAPF	Time Averaged Peak Frequency
TAPV	Time Averaged Peak Velocity
TCD	Transcranial Doppler
TCP	Transfer Control Protocol
TDI	Tissue Doppler Imaging
TEE	Transesophageal
TERM	Terminal
TGC	Time Gain Compensation
TH	Thickness
THOR	Thoracic
THI	Tissue Harmonic Imaging
TI	Thermal Index
TIB	Thermal Index Bone
TIB	Tibia
TOPO	Topography
TR	Tricuspid Regurgitation
TRANS	Transverse
TRT	Transrectal Transducer
TSI	Tissue Specific Imaging
TTD	Transverse Trunk Diameter
TV	Tricuspid Valve
UIF	User Interface
ULN	Ulna
URL	Uniform Resource Locator
Vcf	Rate of Circumferential Fiber Shortening
VCR	Video Cassette Recorder
VEL	Velocity
VERT	Vertebral
VOL	Volume
VTI	Velocity Time Integral
WWW	World Wide Web
XDCR	Transducer
XS	Cross Section
YS	Yolk Sac

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